Record of Decision

Bozeman Solvent Site
Bozeman, Montana

Prepared by:

Montana Department of Environmental Quality
Remediation Division
Helena, Montana

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INTRODUCTION

The Montana Department of Environmental Quality (DEQ) presents the Record of Decision (ROD) for the Bozeman Solvent Site (BSS). The BSS is a maximum priority Comprehensive Environmental Cleanup and Responsibility Act (CECRA, also known as state Superfund) facility. The ROD is based on the identified administrative record, including but not limited to: the remedial investigation (RI); the feasibility study (FS); the baseline human health risk assessment (BHHRA); the Proposed Plan; public comments received on these documents, including those from the liable persons; and other related information. These documents are available for public review at the information repositories listed in Section III of the ROD. The ROD provides a consolidated source of information about the history, characteristics and risks posed by conditions at the BSS, as well as a summary and evaluation of the cleanup alternatives considered, the rationale behind the selected remedy, and DEQ's responses to comments received on the FS or Proposed Plan.

The ROD consists of the following sections:

1. The **Declaration** is a summary of key information contained in the ROD and is the section of the ROD signed by the Director of DEQ.

2. The **Decision Summary** provides an overview of the site characteristics, the alternatives considered and evaluated and the analysis of those options. The Decision Summary also identifies the selected remedy and explains how the remedy fulfills statutory requirements. It includes Appendices, Tables, and Figures.

3. The **Responsiveness Summary** reiterates public comments received on the FS or Proposed Plan and provides DEQ’s response to those comments.

PART 1

DECLARATION OF RECORD OF DECISION

Declaration of Record of Decision

SITE NAME AND LOCATION

The Bozeman Solvent Site (BSS) is a maximum priority state Superfund facility listed on the Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA) Priority List. The majority of the BSS is within the City of Bozeman (City), Montana limits with the northern-most portion of the BSS north of the East Gallatin River, outside the city limits.

STATEMENT OF BASIS AND PURPOSE

This decision document presents the Montana Department of Environmental Quality's (DEQ's) selected remedial action for the BSS in Bozeman, Montana and was developed in accordance with CECRA.

The remedial action set forth in the Record of Decision (ROD) is based on the identified administrative record, which consists of the documents DEQ cited, relied upon, or considered in selecting the remedy for the BSS. The administrative record is identified in Part 2, Section 14.0. The complete administrative record is available for public review at the offices of DEQ, Remediation Division, located at 1100 North Last Chance Gulch in Helena, Montana. A partial compilation of the administrative record is available at the Bozeman City Library, 626 E. Main St., Bozeman, Montana, and on DEQ's website at http://deq.mt.gov/statesuperfund/bozeman_solvent.mcpx.

ASSESSMENT OF THE SITE

DEQ is authorized to take remedial action whenever there has been a release or a threatened release of a hazardous or deleterious substance into the environment that poses or may pose an imminent and substantial endangerment to the public health, safety, or welfare, or the environment. Section 75-10-711, MCA. CECRA defines a hazardous or deleterious substance in Section 75-10-701(8), MCA. The primary contaminant that DEQ identified at the BSS is tetrachloroethene (PCE). Other contaminants are also present and described in Part 2 of the ROD. DEQ has determined that these contaminants are hazardous or deleterious substances under CECRA. Based on the administrative record, DEQ has determined that contaminants have been spilled, leaked, discharged, leached, dumped, or disposed into the environment, which constitutes a release or threatened release under Section 75-10-701(19), MCA.

The potential for an "imminent and substantial endangerment to public health, safety, and welfare, or the environment" is present when contaminant concentrations in the environment exist or have the potential to exist above risk-based screening levels (ARM 17.55.102) and an imminent and substantial endangerment does exist if contaminant concentrations exceed site-specific cleanup levels (SSCLs). DEQ has determined that contamination at the BSS exceeds risk-based screening levels and SSCLs. See Tables 1 through 5 and Section 7.1.1 of the ROD (Part 2). Therefore, DEQ has determined that a release or a threatened release of hazardous or deleterious substances from the BSS poses an imminent and substantial endangerment to the public health, safety, or welfare, or the environment.

DESCRIPTION OF THE REMEDY

The remedy for the BSS consists of remediation of contaminated media to SSCLs as described in the ROD, with reliance on institutional controls. Numerous interim actions have occurred at the BSS. DEQ considered the interim remedial actions and integrated that information and those actions into the remedy to the extent possible. Major components of the remedy are summarized below. Details of the remedy are provided in Part 2, Section 11.0 of the ROD.

Institutional Controls

Institutional controls in the form of groundwater use and land use restrictions are necessary to protect human health and limit migration of contaminants into uncontaminated areas. The remedy partially relies on institutional controls in the form of an existing controlled groundwater area (CGWA) previously issued by the Montana Department of Natural Resources and Conservation (DNRC) which limits the installation of wells within or adjacent to the area of contamination associated with the BSS.

The remedy also requires restrictive covenants, as provided for in Section 75-10-727, MCA, on Lots 1 and a portion of Lot 2 of the former Buttrey's Shopping Center (BSC) to prohibit residential use as on-site SSCLs are based on commercial/industrial exposure. Restrictive covenants will also preclude construction or development of structures in the northwest corner of Lot 2 of the BSC where active treatment (enhanced bioremediation) will occur. This restriction on Lot 2 is limited to the time of active treatment; once the active treatment is complete, the restriction can be removed.

In addition, a trench/excavation permit system will be implemented by the City at the BSC and nearby property to ensure protection of construction or utility workers until COC concentrations in soil vapors are below the SSCLs. The construction trench and excavation permit system will require fresh air mechanical ventilation in construction trenches or excavations on Lots 1 and 2 of the BSC, the eastern edge of 1608 W. Beall St., 1602 W. Beall St., the southeast corner of 1605 W. Beall St., the southwest corner of 302 N. 16th Ave., and the City right of way associated with the intersection of W. Beall St. and N. 16th Ave (see Figure 18). The trench and excavation dimensions are described in Section 11.2.1.2.

Restrictive covenants and permits will be in effect until DEQ determines they are no longer needed to ensure protection of human health or to limit migration of contaminants into uncontaminated areas. With regard to the CGWA, DEQ will notify DNRC when groundwater site-specific cleanup levels (SSCLs) are met and this ROD is fully implemented.

Long-Term Groundwater Monitoring

The remedy requires the City and CVS Pharmacy, Inc. (CVS) to continue to monitor (collect groundwater samples) residential, commercial, and public water supply drinking water wells that are within the BSS, including wells north of the East Gallatin River. The City and CVS will also

monitor drinking water wells installed under the existing CGWA. Drinking water wells will be monitored semi-annually to annually.

In addition, long-term monitoring will be conducted on other groundwater wells within the BSS to evaluate the effectiveness of the remedy described below and to track contaminant concentrations until SSCLs are met. At a minimum, monitoring of selected wells will be conducted on a semi-annual basis for the first five years and at a reduced frequency thereafter, until SSCLs are achieved.

City Water Connections

The remedy requires the City and CVS to continue to provide an alternate municipal water supply to all residences and businesses within the BSS whose drinking water wells have PCE concentrations that exceed the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL)/Montana groundwater quality standard (DEQ-7) of 5 micrograms per liter [µg/L]. Existing drinking water wells will be monitored by the City and CVS. If PCE exceeds the MCL/DEQ-7 standard of 5 µg/L, and is confirmed with subsequent sampling, in a drinking water well south of the East Gallatin River and within the BSS, the City and CVS will connect the impacted residence or business to City water.

New or Deeper Replacement Drinking Water Wells

The remedy requires the City and CVS to monitor existing drinking water wells north of the East Gallatin River within the BSS where City water services are not available. If PCE exceeds the MCL/DEQ-7 standard of 5 µg/L in a drinking water well, the City and CVS will install a new or deeper replacement drinking water well. The City and CVS will continue to monitor the new or deeper replacement drinking water wells to evaluate PCE concentration trends until SSCLs are met.

On-site Residual Source

The remedy includes enhanced bioremediation to treat the on-site residual source at the BSC, including saturated soils, intermittently saturated soils, and groundwater, which will reduce contaminant concentrations of PCE in groundwater. Enhanced bioremediation utilizes injection wells to deliver an organic substrate to stimulate microbial growth and development creating anaerobic conditions. A pilot test at the BSS demonstrated that enhanced bioremediation reduced PCE concentration in on-site shallow groundwater. Methane and vinyl chloride vapors were generated during the pilot test, but were addressed through a soil vapor extraction (SVE) system. An SVE system will be used, as necessary, to mitigate methane and vinyl chloride vapors that are generated during the enhanced bioremediation portion of the remedy to ensure protection of receptors (i.e. indoor air in off-site structures).

During the selected remedy of enhanced bioremediation, vinyl chloride will likely be generated and increases in concentrations exceeding the DEQ-7 standard (0.2 µg/L) downgradient of the treatment area are likely to be observed. The ROD requires that injection rates and substrate concentrations be evaluated during remedial design to minimize vinyl chloride generation in off-

site groundwater during implementation. The ROD includes the installation and/or monitoring of wells downgradient (off-site) of the treatment area to evaluate vinyl chloride concentrations. If monitoring indicates that vinyl chloride is not oxidizing at a rate that will prevent receptors (i.e., drinking water wells) from being exposed to unacceptable levels of contamination, DEQ will require the use of air sparging as an additional remedial measure to protect human health. The FS identified air sparging as a remedy that is effective on chlorinated solvents and meets CECRA criteria. Air sparging was not selected as the primary remedy, but can be used as a polishing tool to address vinyl chloride concentrations in groundwater downgradient of the enhanced bioremediation treatment area if receptors are threatened.

Soil Vapors Beneath the BSC Building

The remedy includes removing sub-slab soil vapors beneath the BSC building by utilizing an SVE system. Removal of the sub-slab vapors will reduce the potential for these vapors to move upward and impact indoor air in the BSC building. The vapor will be treated prior to discharge to the atmosphere.

The ROD includes soil vapor sampling along the former sewer area to determine if COCs in soil vapor exceed the SSCLs. This sampling will occur as part of remedial design. Based upon the results of the sampling, DEQ will determine if the SVE system needs to address that area.

If there is commercial/industrial development on that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs, the SVE system for on-site sub-slab soil vapors will be expanded, as necessary, to remove contaminated soil vapor from beneath the new building.

Off-site Dissolved Contamination in Groundwater

Monitored Natural Attenuation (MNA) is the remedy to address the off-site dissolved PCE in groundwater. The off-site dissolved groundwater concentration trends are established and on-site source removal will occur. Fate and transport groundwater modeling predicts the PCE concentrations in the dissolved groundwater plume will peak in about 5 to 10 years, depending upon each well's location relative to the leading edge of the plume, then begin to decline to below the DEQ-7 standard. This remedy relies on on-site source removal to reduce concentrations of dissolved PCE added to the groundwater. In addition, remedies to prevent the public from being exposed to groundwater that has contaminant concentrations exceeding the standards will be in place.

STATUTORY DETERMINATIONS

The selected remedy will attain a degree of cleanup that assures present and future protection of public health, safety, and welfare, and the environment, and complies with federal and state environmental requirements, criteria, and limitations (ERCLs) that are applicable or relevant to the remedial action and site conditions. The remedy mitigates risk, is effective and reliable in the short- and long-term, is practicable and implementable, uses treatment and resource recovery technologies and engineering controls, and is cost-effective. DEQ has considered all public comment received during the public comment period on the Proposed Plan and has responded to

these comments in Part 3 of the ROD. DEQ has also considered the acceptability of the remedy to the affected community, as indicated by community members and the local government, in determining the final remedy at the BSS.

AUTHORIZING SIGNATURE

Richard H. Opper
Director
Montana Department of Environmental Quality

8/18/11
Date

PART 2

DECISION SUMMARY

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Acronyms and Abbreviations

ARM	Administrative Rules of Montana
ATC	ATC Associates, Inc.
ATSDR	Agency for Toxic Substances and Disease Registry
BER	Montana Board of Environmental Review
bgs	Below ground surface
BHHRA	Baseline Human Health Risk Assessment
BRAWP	Baseline Risk Assessment Work Plan
BSC	Buttrey's Shopping Center
BSS	Bozeman Solvent Site
CECRA	Montana Comprehensive Environmental Cleanup and Responsibility Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
CGWA	Controlled Groundwater Area
City	City of Bozeman
COC	Contaminant of concern
COPC	Contaminant of potential concern
CVS	CVS Pharmacy, Inc.
DCE	*cis*-1,2-Dichloroethene or cis-1,2-Dichloroethylene
DEQ	Montana Department of Environmental Quality
DEQ-7	Montana Numeric Water Quality Standards
DHHS	U.S. Department of Health and Human Services
DNAPL	Dense Non-aqueous Phase Liquid
DNRC	Montana Department of Natural Resources and Conservation
EPA	U.S. Environmental Protection Agency
ERCLs	Environmental requirements, criteria, and limitations
ESD	Explanation of Significant Difference
FS	Feasibility Study
FSWP	Feasibility Study Work Plan
ft	Feet
ft/day	Feet per day
GAC	Granulated activated carbon
gpm	Gallons per minute
HVAC	Heating, Ventilation, and Air Conditioning
LEL	Lower Explosive Level

MCA	Montana Code Annotated
MCL	EPA Maximum Contaminant Level
MDHES	Montana Department of Health and Environmental Sciences, predecessor to DEQ
MDT	Montana Department of Transportation
mg/kg	Milligrams per kilogram
MNA	Monitored natural attenuation
NE&W	Nicklin Earth and Water, Inc.
NPL	National Priorities List
O&M	Operations and maintenance
PCE	Tetrachlorethene or Tetrachloroethylene
ppm	Parts per million
PVC	Polyvinyl chloride
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RMRG	Red Mountain Retail Group
ROD	Record of Decision
ROI	Radius of Influence
SCEM	Site Conceptual Exposure Model
SSCLs	Site-Specific Cleanup Levels
sq ft	Square feet
SVE	Soil Vapor Extraction
TCE	Trichloroethene or Trichloroethylene
UEL	Upper Explosive Limit
µg/L	Micrograms per liter
$\mu g/m^3$	Micrograms per cubic meter
µS/cm	MicroSiemens per centimeter
VOC	Volatile organic compound

1.0 SITE NAME, LOCATION AND DESCRIPTION

The Bozeman Solvent Site (BSS) is a maximum priority Comprehensive Environmental Cleanup and Responsibility Act (CECRA) facility located in Bozeman, Montana. The majority of the BSS is within the City of Bozeman (City) limits. The northern-most portion of the BSS is north of the East Gallatin River, outside the city limits. The BSS consists of about 700 acres and includes Township 1 South, Range 5 East, Sections 25, 26, 35, and 36 and Township 2 South, Range 5 East, Sections 1 and 12. As defined in Section 75-10-701, Montana Code Annotated (MCA), the actual BSS facility boundaries are based on wherever contamination has come to be located, and groundwater contamination is known to extend to the northeast of the former Buttrey's Shopping Center (BSC) to the North 7th Avenue and Interstate 90 (I-90) interchange, and to the north side of the East Gallatin River (Figure 1). The surficial boundaries of the BSS generally extend from the BSC (1625 West Main Street), now known as the Hastings Shopping Center, on the south, to approximately 500 feet north of the East Gallatin River. North 19th Avenue is the approximate western boundary of the BSS. The eastern boundary extends from the BSC to the North 7th Avenue and I-90 interchange then north of the East Gallatin River northeast of Cherry Springs. The BSS includes residential areas, commercial facilities, and some light manufacturing facilities.

2.0 SITE HISTORY

2.1 OWNERSHIP AND OPERATIONAL HISTORY

This section presents an overview of the property ownership and operational history for the BSC portion of the BSS. The ownership of the BSC is described below:

- May 1960 – Buttrey Foods, Inc. entered into an agreement to sell the property to H. F. Hustad (Agreement, 1960). This agreement also provided that Buttrey Foods, Inc. would advance funds to Hustad for the purpose of constructing the improvements on the property. The Hustad Corporation leased the property from Buttrey Foods, Inc. and constructed the shopping center in 1960 (Lease, 1960).

- June 1960 – Marguerite Kirk sold the property to Buttrey Foods, Inc., a Montana corporation (Deed, 1960).

- November 1960 – The property was annexed into the city limits (Bozeman, 1960).

- June 1966 – Buttrey Foods, Inc. and Jewel Tea Co., Inc. merged into Jewel Tea Co., Inc. (Certificate, 1966a).

- June 1966 – Buttrey Foods, Inc. transferred the property to Jewel Tea Co., a New York corporation, because the May 25, 1960 agreement was not filed (Deed, 1966a). Jewel

Tea Co., Inc. then transferred the property to Buttrey Foods, Inc. a Delaware Corp. (Deed, 1966b).

- June 1966 – Jewel Tea Co., Inc. amended its name to Jewel Companies, Inc. and merged into Jewel Tea Co., Inc. (Certificate, 1966b).

- February 1968 – Buttrey Foods, Inc. transferred the property to Jewel Companies, Inc., a New York corporation (Jewel) (Deed, 1968).

- Summer 1984 – American Stores Company (American Stores) acquired Jewel Companies Inc. as a wholly owned subsidiary (Jewel, 1990).

- May 1986 – Skaggs Alpha Beta, Inc. assumed all obligations and liabilities and assets from the Buttrey Division of Jewel Companies including the BSC in Bozeman, Montana (Agreement, 1986).

- June 1999 – Albertson's Inc. acquired American Stores (Funding Universe, 2011 and Reference for Business, 2011).

- December 2002 – Jewel transferred title of the BSC property to RMRG Portfolio, LLC (Deed, 2002a).

- December 2002 – RMRG Portfolio, LLC conveyed to Corona McKinely, LLC a 26.955% undivided tenants-in-common interest and to Red Mountain Plaza II, LLC a 3.587% undivided tenants-in-common interest (Deed, 2002b).

- November 2003 – The December 2002 undivided tenants-in-common interest conveyance was conveyed back to RMRG Portfolio, LLC from Corona McKinely, LLC and Red Mountain Plaza II, LLC (Deed, 2003).

- March 2004 – RMRG Portfolio, LLC transferred title of the property to Bozeman Shopping Center, LLC (Deed, 2004).

- September 2004 – The property was subdivided into four separate lots pursuant to the Plat of Minor Subdivision 352 (Plat, 2004).

- September 2005 – Bozeman Shopping Center, LLC conveyed lots 2 and 3 of Minor Subdivision 352 to Bozeman Shopping Center III, LLC and lot 4 to Bozeman Shopping Center II, LLC (Deed, 2005a and Deed, 2005b).

- June 2006 – CVS Pharmacy, Inc. assumed responsibilities of Albertsons Inc. and Jewel Food Stores at the BSS for continuation of future investigation and remedial actions (Albertsons, 2006). (For ease of reference, CVS and its predecessors will be referred to as CVS throughout the rest of this document except in Section 2.2.)

- September 2008 – Bozeman Shopping Center II, LLC conveyed lot 4 of Minor Subdivision 352 to M532MT, LLC (Deed, 2008).

- June 2010 – Lot 3 of Minor Subdivision 352 was subdivided into lot 3-A and Tract A (Plat, 2010a). Bozeman Shopping Center III, LLC transferred Tract A to McDonald's Real Estate Company (Deed, 2010).

- October 2010 – Lot 2 was amended to incorporate Tract 2 to create Tract A2 in Minor Subdivision 352B. (Plat, 2010b).

Currently the Bozeman Shopping Center LLC and Bozeman Shopping Center III, LLC own the BSC property. Red Mountain Retail Group, Inc. and Red Mountain Group, Inc. are both managers of the Bozeman Shopping Center, LLC and Bozeman Shopping Center III, LLC (Phillips, 2011).

The BSC consists of a single story building that currently has 12 individual retail spaces, including CVS Pharmacy and Hastings Book Store (Figure 2) (CDM, 1995 and Kleinfelder, 2010b). A dry cleaning establishment commenced operation at BSC in 1960 and transferred ownership as follows:

- J & M Cleaners (Jack French) - October 1960 through March 1973;
- One Hour Cleaners (A. Freese and Helen Dobson) - April 1973 through July 1977;
- One Hour Cleaners (David Iddles) - July 1977 through November 1981;
- One Hour Cleaners (Alan and Catherine Iddles) - December 1981 through March 1983; and
- City Cleaners (Gordon Fuller) April 1983 through July 1993 (Jewel v. City, 1994a; Jewel v. City, 1994b; Jewel v. City, 1994c; Jewel v. City, 1994d; Jewel v. City, 1994e; Jewel v. City, 1995a; Jewel v. City, 1995b; and Jewel v. City, 1995c).

The BSC sewage system originally consisted of conveyance piping, four manholes, a septic tank and two seepage pits. The sewer system, which served the shopping center, was connected to the municipal sewer system in 1964 (Bozeman, 1964). On August 12, 1970, the conveyance piping (sewer line) and manholes of the shopping center sewer system were deeded to the City (Agreement, 1970). The City has since owned and operated the sanitary sewage conveyance piping and manholes that service the BSC. The City abandoned the original sewer line and installed a new sewer line at BSC in 1994 (NE&W, 1998 and 1999b). See Figure 3 for a history of the BSC sewage system and sanitary sewer system.

In 1989, the Montana Department of Health and Environmental Sciences (MDHES) conducted a survey of public water supply wells in Montana. (Through legislative action in 1995, certain sections of MDHES were transferred to a new department, the Montana Department of Environmental Quality [DEQ]. For ease of reference, MDHES and DEQ will both be referred to as DEQ throughout the rest of this document.) During this survey, tetrachloroethene (PCE) was detected in a public water supply well at the Nelson Mobile Home Park (DEQ, 1989). The Nelson Mobile Home Park is located approximately 2,200 feet north of the BSC (NE&W, 1999b and 2011d). The PCE was ultimately traced back to the BSC. On February 27, 1990, the City

and DEQ discovered that a septic tank system at BSC was not disconnected and/or abandoned and was still connected to the municipal sewer system (DEQ, 1990a).

The dry cleaner businesses that operated at the BSC from 1960 until 1993 discharged PCE into the former sewer line (NE&W, 1999b). The PCE was released into the subsurface at the BSC through leaks and defects in the former sewer line and through the septic tank which had not been disconnected from the sewer line.

PCE is a synthetic chemical that is widely used for dry cleaning of fabrics and for metal-degreasing operations (ATSDR, 1997a). PCE is denser or heavier than water and is commonly referred to as dense non-aqueous phase liquid (DNAPL) (Pankow, et al, 1996). If spilled into the subsurface in sufficient quantities, a DNAPL has the capacity to move below the groundwater table where it can provide a long term source of contamination.

PCE contaminated the soil, soil vapor, and groundwater at the BSS. Soil contamination is primarily limited to the saturated soils beneath and adjacent to the former sewer line and the former septic system at the BSC. Contamination has not been detected in surface soils or off-site soils (NE&W, 1999b). Soil vapor contamination is primarily limited to the BSC property, including beneath the BSC building, along the former sewer line behind the BSC building, and the area immediately north of the BSC property to Beall Street (Kleinfelder, 2010a and 2010b). Groundwater contamination extends from the BSC to the north side of the East Gallatin River, approximately 2.5 miles away (NE&W, 2011d). Groundwater contamination is between six and 130 feet (ft) below ground surface (bgs) at the BSS. Groundwater contamination is present in a drinking water well constructed to a depth of 120 ft bgs on the north side of the East Gallatin River (ATC, 2011b).

2.2 REGULATORY HISTORY

A number of regulatory actions have been conducted at the BSS over the years. These actions are briefly described below:

- In August 1990, DEQ issued Water Quality Order WQ-90-002 to the City requesting ownership and operator information regarding the BSC (DEQ, 1990b).

- In August 1990, the BSS was listed on the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS) list (CERCLIS ID #MTD986067627) (EPA, 2011a).

- In September 1990, DEQ issued Water Quality Order WQ-90-002-A1 clarifying information requested in WQ-90-002 and extending submittal dates (DEQ, 1990c).

- In October 1991, DEQ issued Water Quality Order WQ-91-0001 to Jewel Food Stores, Inc. and Skaggs Alpha Beta, Inc. and identified all the parties as liable for a release of a hazardous or deleterious substance from the facility. Water Quality Order WQ-91-0001 required the parties to prepare an investigation work plan, septic system removal work plan, and groundwater monitoring work plan (DEQ, 1991a). In November 1991, DEQ

issued the First Amendment to WQ-91-0001 to revise dates for submitting work plans and initiating work (DEQ, 1991b).

- In December 1991, DEQ sent a notice of potential CECRA liability to the City in accordance with Section 75-10-715(1), MCA (DEQ, 1991c).

- In December 1991, DEQ sent a notice of potential CECRA liability to Gordon Fuller d/b/a City Cleaners in accordance with Section 75-10-715(1), MCA (DEQ, 1991d).

- In July 1992, DEQ issued a public health notice to inform the public of potential threats to human health and the environment associated with the use of contaminated groundwater and drilling of water wells (DEQ, 1992a).

- In August 1992, DEQ sent an information request and a notice of potential CECRA liability to Richard Harte, Bozeman Exxon, and Jerome Marcotte d/b/a Bozeman Exxon in accordance with Section 75-10-715(1), MCA (DEQ, 1992b).

- In June 1993, DEQ issued Water Quality Order WQ-93-101 to Jewel Food Stores, Skaggs Alpha Beta, Inc., and the City and identified all parties as liable for a release of a hazardous or deleterious substance from the facility (DEQ, 1993a). Water Quality Order WQ-93-101 required the parties to provide alternate water supplies, develop and implement work plans for water treatment systems, and conduct groundwater monitoring. DEQ issued the First Amendment to WQ-93-101 to revise the effective date of the order (DEQ, 1993b).

- In December 1993, DEQ issued the Second Amendment to WQ-93-101 to clarify the submittal and review process of the Work Plan (DEQ, 1993d).

- In July 1994, DEQ issued a public health notice advising the public not to drink groundwater if the PCE concentration was more than 5 µg/L, the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL) for drinking water. DEQ also indicated that it was acceptable to use PCE contaminated groundwater for irrigation purposes if certain recommendations were followed. In addition, DEQ advised against the installation of new wells in the area affected by this notice (DEQ, 1994b).

- In July 1995, American Stores indicated that because it had identified other potential sources of PCE, it did not believe the contaminated soil impacted by sewer leakage was a Resource Conservation and Recovery Act (RCRA) listed hazardous waste from dry cleaning (JWH&M, 1995). Based on information provided by American Stores, DEQ concurred with American Stores' determination that the PCE was not a 'F' listed waste based on PCE being found in a septic system and sewer line to which several business establishments were connected, as well as the fact that while there was an active drycleaner at the BSC connected to the sewer line, there were also automotive repair facilities which may also have used PCE (DEQ, 1995c).

- In July 1995, DEQ issued the Third Amendment to WQ-93-101 to revise its name to DEQ and to clarify persons eligible for an alternate water supply order (DEQ, 1995b).

- In March 1996, DEQ issued a Special Notice Letter to American Stores, Jewel Food Stores, Inc. and Skaggs Alpha Beta, Inc. and identified all parties as liable for releases or threatened releases of hazardous or deleterious substances at the BSS (DEQ, 1996b). The Special Notice Letter required the parties to perform a Remedial Investigation and Feasibility Study (RI/FS) at the Facility.

- In March 1996, DEQ sent a notice of potential CECRA liability to Dr. Alan Iddles and Mrs. Molly Iddles, individually, on behalf of and d/b/a City Cleaners, in accordance with Section 75-10-715(1), MCA (DEQ, 1996c).

- In March 1996, DEQ sent a notice of potential CECRA liability to Clark Gordon Fuller and Donna Lea Fuller, individually, on behalf of and d/b/a City Cleaners, in accordance with Section 75-10-715(1), MCA (DEQ, 1996d).

- In April 1996, DEQ issued the Fourth Amendment to WQ-93-101 to revise the definition of "Area" (DEQ, 1996e).

- In July 1996, DEQ and the City entered into a Memorandum of Agreement requiring that the City complete the RI/FS for the BSS (MOA, 1996).

- In June 2000, DEQ issued the Fifth Amendment to WQ-93-101 to clarify areas where Jewel Food Stores, Inc., Skaggs Alpha Beta, Inc., and the City were to provide an alternate municipal water supply system (DEQ, 2000a).

- In October 2000, DEQ sent a notice of potential CECRA liability to Lux Transfer & Storage, Inc in accordance with Section 75-10-715(1), MCA (DEQ, 2000c).

- In July 2001, DEQ sent a notice of potential CECRA liability to Peter K. Nelson in accordance with Section 75-10-715(1), MCA (DEQ, 2001b).

- In March 2005, DEQ issued the Sixth Amendment to WQ-93-101 to revise the PCE trigger concentration from 0.5 to 5 micrograms per liter (µg/L) to be consistent with the Montana Numeric Water Quality Standard (DEQ-7) for providing an alternate municipal water supply (DEQ, 2005b).

2.3 INVESTIGATION HISTORY

In addition to the regulatory events described above, a number of investigations have been conducted at the BSS. These investigations are briefly described below:

- In 1989 and 1990, DEQ collected groundwater samples from public water supply wells, private water wells, monitoring wells, and water and sludge samples from sewer lines to

identify potential sources for the PCE (DEQ, 2011j and 2011k). During this investigation, DEQ discovered that the inlet to the septic tank at the BSC was not plugged and isolated from the sewer line or had become unplugged (DEQ, 1990a).

- In 1990, DEQ prepared a Preliminary Assessment (PA) for Nelson's Mobile Home Park (CERCLIS ID # MTD986067627) to determine if the site posed a threat to human health and the environment and if the threat required further investigation (DEQ, 1990d).

- In 1992, DEQ conducted a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Site Inspection (SI) to determine the National Priorities List (NPL) eligibility of the site by determining background groundwater quality and contaminant levels in drinking water wells, and by providing adequate quality assurance and quality control to substantiate previously collected data (MSE, 1992). Currently, the BSS is not on the NPL. The current non-NPL status for the BSS is listed as "Assessment complete – Decision Needed" (EPA, 2011a).

- In 1992, CVS collected soil vapor and soil samples in the area of the septic system and monitored groundwater quality to characterize the extent of PCE (PRC, 1992a and 1994b).

- In 1992, the City conducted a video survey of the former sewer line at the BSC to evaluate the condition of the sewer line (NE&W, 1998).

- In 1992, the Agency for Toxic Substances and Disease Registry (ATSDR) conducted a health consultation to evaluate potential health effects from exposure to PCE contaminated groundwater (ATSDR, 1992).

- In 1993, the Montana Department of Transportation (MDT) collected groundwater samples at the site of the future I-90 and North 19th Avenue interchange to determine PCE concentrations and evaluate methods to address PCE contaminated groundwater encountered during construction of the interchange (MDT, 1993).

- In 1993, the City sampled groundwater along the proposed Northwest Water Line Installation Project to determine PCE concentrations prior to construction activities (Canonie, 1993a).

- Between 1993 and 1997, the City and CVS conducted additional investigations for private litigation purposes, including sampling of sewage effluent, and installation of monitoring wells (DEQ, 2011p).

- In 1994, CVS submitted a summary report for investigations conducted at the BSC (PRC, 1994b) and conducted an irrigation study to determine the impact of irrigating lawns and gardens with PCE contaminated groundwater (PRC, 1994c). Also in 1994, DEQ conducted follow-up sampling to the irrigation study to determine the fate of PCE contaminated irrigation water in soils at the BSS (MBMG, 1994).

- In 1995, ATSDR conducted a second health consultation to further evaluate potential health effects from exposure to PCE contaminated groundwater and PCE contaminated vapors (ATSDR, 1995).

- In 1996, the City conducted soil, soil gas, surface water, sediment, and groundwater sampling for the RI (NE&W, 1999b).

- In 1997, ATSDR evaluated potential human exposure risks to soil gas contaminants volatilizing from the PCE contaminated groundwater. ATSDR also evaluated potential risks to human health related to the movement of PCE contaminated groundwater (ATSDR, 1997c).

- In 2006, Red Mountain Retail Group (RMRG) collected subslab soil vapor samples from the Hastings Video and Bookstore retail space (RMRG, 2006 and RTI, 2006).

- In 2006 and 2007, the City and CVS conducted a source area investigation to better define subsurface conditions in the former septic system area and limited portions along the former sewer line at the BSC to gather information for design of an enhanced bioremediation pilot test (Tetra Tech, 2008).

- In 2007, RMRG conducted an industrial hygiene survey at the Hastings Video and Book Store and the CVS Pharmacy at the Hastings Shopping Center. The survey included the collection of personal breathing zone and area air samples using SKC personal air sampling pumps (HTI, 2007 and RMRG, 2007).

- In 2007, the City and CVS conducted an indoor air/subslab vapor investigation at the Hastings Bookstore and CVS Pharmacy retail stores to evaluate vapor intrusion issues at the BSC (Kleinfelder, 2010b).

- In 2008, the City and CVS conducted a pilot test to evaluate the effectiveness of enhanced bioremediation at reducing PCE concentrations in the groundwater (ATC, 2010d).

- In 2009, the City and CVS conducted a follow-up indoor air/subslab vapor investigation at the Hastings Video and Bookstore, CVS Pharmacy, and Corral West Ranchwear retail spaces to further evaluate vapor intrusion issues at the BSC (Kleinfelder, 2010b).

- In 2009, the City and CVS conducted a soil vapor survey in the area north of the BSC to evaluate possible intrusion of PCE vapors into buildings from underlying PCE contaminated groundwater (Kleinfelder, 2009a and 2010a).

- In 2010, the City and CVS conducted an indoor air/subslab vapor investigation in a number of residences and a business in the neighborhood north of the BSC to evaluate if vapor intrusion was occurring from underlying PCE contaminated groundwater (Kleinfelder, 2010b).

- In 2010, the City and CVS conducted soil sampling along the former sewer line to evaluate the effectiveness of the soil vapor extraction (SVE) system that operated along the former sewer line in the 1990s (ATC, 2010b).

The results for the various investigations described above are discussed in Section 5.0.

2.4 INTERIM REMEDIAL ACTION HISTORY

Numerous interim remedial actions have occurred at the BSS. DEQ considered the interim remedial actions and integrated that information and actions into the remedy to the extent possible. Interim remedial actions conducted at the BSS include the following:

- Between 1989 and 1993, a number of residents and public water supply operators connected to City water at their own expense because their drinking water wells were contaminated with PCE (Harris, 1995 and NE&W, 1996c).

- In 1990, the City disconnected and isolated the septic system from the sewer line to prevent PCE contaminated sewer water from entering the system and discharging into the subsurface (Brawner, 1990).

- In 1992, CVS removed the septic tank, and its contents as part of source removal and installed a SVE system to remediate contaminated soil near the septic system; provided bottled water to people with impacted drinking water wells; and monitored groundwater quality to characterize the nature and extent of PCE in the groundwater (PRC 1992a, 1992b, and 1994d).

- Between 1993 and 1997, the City and CVS conducted separate interim actions, including SVE, and sewer line replacement (DEQ, 2011p).

- In 1993, the City and CVS began providing permanent alternate water to some people whose drinking water was contaminated with PCE. This included bottled water, point-of-use water treatment systems, and the development of plans to extend City water to the North 19th Avenue and I-90 interchange area and along Frontage Road (DEQ, 2011q).

- In 1994, CVS installed granulated activated carbon (GAC) point-of-use water treatment systems at businesses impacted by PCE contamination (DEQ, 2011m).

- In 1994, the City replaced the sewer line at BSC. The former sewer line was removed from service to prevent further leaks to the subsurface. PCE contaminated soil was removed from some portions of the former sewer line as part of source removal to prevent PCE from further leaching to groundwater (NE&W, 1998).

- In 1995, the MDT operated a groundwater treatment system during the construction activities at the North 19th Avenue and I-90 interchange project to address PCE contaminated groundwater encountered during construction (Earth Report, 1995).

- In 1995, the City installed an SVE system to remediate contaminated soils adjacent to the former sewer line (NE&W, 1999a).

- In 1997, the City lined a portion of Walton Ditch adjacent to the BSC to mitigate water losses from the ditch that may result in temporary localized groundwater mounding and further movement of PCE at the BSC (NE&W, 2011b).

- In 1998, the Montana Department of Natural Resources and Conservation (DNRC) issued the BSS Controlled Groundwater Area (CGWA) Order (DNRC, 1998). The CGWA Order established a permitting process for the installation of groundwater wells to prevent exposure to PCE contaminated groundwater and to mitigate movement of PCE contaminated groundwater into areas not contaminated. The CGWA boundary includes the contaminant plume plus a 1000 foot buffer (See Figure 1).

- In 2001, the City completed the connection of all Exhibit A wells identified in the Fifth Amendment to WQ-93-101 to an alternate municipal water supply (Bozeman, 2001a).

- In 2001, the City completed the expansion of its water supply line along American Simmental Way, north of the BSC, to provide alternate drinking water to residents and businesses impacted with PCE (MOR, 2001d).

- In 2004, the City installed a water treatment system on a residential well (R-57) located on the north side of the East Gallatin River due to the presence of PCE concentrations that exceeded the trigger concentration of 0.5 μg/L as defined in Water Quality Order WQ-93-101 and the absence of City water services on the north side of the East Gallatin River (DEQ, 2011l).

- In 2005, the City replaced a residential well (R-57) located on the north side of the East Gallatin River with a deeper well because the shallow well had PCE concentrations that exceeded the trigger concentration of 0.5 μg/L as defined in Water Quality Order WQ-93-101 (Maxim, 2005a).

3.0 COMMUNITY PARTICIPATION

Shortly after discovery of the BSS, local residents impacted by the BSS contamination formed the BSS Citizens' Group (Citizens' Group). Through the 1990s, the Citizens' Group was involved in review of remediation work plans; contacting residents about contaminants of concern (COCs), alternate water provisions, status of investigations and interim actions conducted at the BSS; and providing input to DEQ about the concerns of the residents.

In 1992 and 1994, DEQ issued public notices advising area residents on the use of contaminated groundwater from the BSS and advising against the installation of new groundwater wells in the area to reduce the public and environmental exposure to contaminated groundwater (DEQ, 1992a

and DEQ, 1994b). In addition, DEQ contacted the DNRC Board of Water Well Contractors and local water well drillers regarding the July 1994 Public Health notices (DEQ, 1994c).

DEQ provided opportunities for public involvement not required by CECRA, including but not limited to: seeking public comment on the Draft Final Phase RI Work Plan (RIWP), the Draft Final Phase RI Report, the final draft Feasibility Study Work Plan (final draft FSWP), the draft final Baseline Risk Assessment Work Plan (draft final BRAWP), and the Final Draft Feasibility Study (Final Draft FS). In addition, DEQ held scoping meetings for the RI and FS with the liable persons.

The RIWP for the BSS was made available to the public from June 21 to July 22, 1996. DEQ provided notice of the public comment period and public meeting via postcard mailings and a display ad in the Bozeman Chronicle (DEQ, 1996f). A legal notice of the public comment period and public meeting was published in the Bozeman Chronicle (DEQ, 1996g). DEQ held a public meeting on July 16, 1996 to discuss the sampling and analysis plan, quality assurance project plan, and health and safety plan to conduct the remedial investigation. A responsiveness summary, which provides a response to each comment submitted during the public comment period on the RIWP, was made available to those who provided comments and the general public on August 19, 1996 (DEQ, 1996h). The final RIWP (NE&W, 1997) was made available to the public in January 1997.

The Draft Final Phase RI Report for the BSS was made available to the public from February 9 to March 10, 1998 with an extension granted through March 23, 1998 (DEQ, 1999a). A responsiveness summary, which provides a response to each comment submitted during the public comment period on the RI Report, was made available to those who provided comments and the general public on August 5, 1999 (DEQ, 1999a). The Final Phase RI Report (NE&W, 1999b) was made available to the public in September 1999.

The final draft FSWP for the BSS was made available to the public from September 25 to October 24, 2000. DEQ provided notice of the public comment period via a legal notice of the public comment period that was published in the Bozeman Chronicle (DEQ, 2000b). DEQ received requests to extend the public comment period and agreed to provide a 13-day extension. A responsiveness summary, which provides a response to each comment submitted during the public comment period on the FSWP, was made available to those who provided comments and the general public on December 4, 2000 (DEQ, 2000d). The final draft FSWP (NE&W, 2000) was made available to the public in January 2001.

The draft final BRAWP for the BSS was made available to the public from August 6 to September 4, 2001. DEQ provided notice of the public comment period via postcard mailings and a legal notice of the public comment period that was published in the Bozeman Chronicle (DEQ, 2001c). A responsiveness summary, which provides a response to each comment submitted during the public comment period on the BRAWP, was made available to those who provided comments and the general public in December 2001 (DEQ, 2001d). The Final BRAWP (MSE, 2001) was made available to the public in December 2001.

The Final Draft FS (NE&W, 2011a) and the Proposed Plan (DEQ, 2011b) (in accordance with Section 75-10-713, MCA) were made available to the public from February 28 to March 29, 2011. DEQ provided notice of the public comment period and public meeting/hearing associated with the FS and Proposed Plan via postcard mailings, news releases, website posting, and a site update distributed to the mailing list (DEQ, 2011o). A legal notice of the public comment period and public meeting/hearing was published on February 28, 2011 in the Bozeman Chronicle and on DEQ's website (DEQ, 2011c). DEQ held a public meeting/hearing on March 9, 2011 to present and discuss the FS and Proposed Plan, answer questions, and to receive oral public comments.

In addition to the fact sheet for the FS and Proposed Plan, DEQ distributed a number of fact sheets and updates describing the status of alternate water provisions and the status and results of investigations (DEQ, 1996a, 1996f, 2009c, 2010f, and 2011t). In addition, DEQ held a number of public meetings to discuss alternate water and investigations. DEQ also issued news releases and posted announcements and documents on its website. DEQ contact information was provided in all fact sheets, updates, and new releases, on DEQ's website, and at public meetings. DEQ responded to numerous individual inquiries.

Notice of the Record of Decision (ROD) for the BSS will be published in accordance with Section 75-10-713, MCA, and a copy of the ROD will be available to the public at the information repository at the Bozeman City Library, DEQ's office in Helena, and on DEQ's website. The ROD is accompanied by a discussion of any notable changes to the selected remedy presented in the Proposed Plan along with reasons for the changes. Also included in Part 3 of the ROD is a Responsiveness Summary, which provides a response to each of the comments received during the comment period on the Final Draft FS and Proposed Plan.

The administrative record that contains the documents cited, relied upon, or considered in selecting the final remedy for the BSS (see Section 14.0) is located at:

Montana Department of Environmental Quality
Remediation Division
Hazardous Waste Site Cleanup Bureau
1100 North Last Chance Gulch
Helena, MT 59601
Telephone: (406) 841-5000

A partial compilation of the administrative record can be found on DEQ's website at http://deq.mt.gov/statesuperfund/bozeman_solvent.mcpx. In addition, a repository for the BSS was established and contains documents that were available for public comment, final documents, and groundwater monitoring reports. The BSS repository is located at:

Bozeman City Library
626 East Main Street
Bozeman, MT 59715
(406)-582-2406

4.0 SCOPE AND ROLE OF REMEDIAL ACTION

As described in Section 1.0, the BSS consists of about 700 acres generally extending from the BSC to approximately 500 ft north of the East Gallatin River. Although the size of the BSS is large, DEQ did not divide the BSS into operable units. The RI, Baseline Human Health Risk Assessment (BHHRA), and FS looked at the BSS area as a whole. The subsequent investigations were specific to addressing certain data gaps.

The purposes of the RI, BHHRA, FS, and subsequent investigations were to collect data necessary to adequately characterize the BSS for developing and evaluating effective remedial alternatives that address human health and environmental risks at the facility. The primary objectives of the RI, BHHRA, FS, and subsequent investigations for the BSS include the following:

- Adequately characterize the nature and extent of releases or threatened releases of hazardous or deleterious substances;
- Allow an assessment of health and ecological risks and development of site-specific cleanup levels (SSCLs);
- Allow the effective development and evaluation of alternative remedies to be included in the FS; and
- Develop and evaluate remedial alternatives so that a final remedy can be selected for the BSS.

The City, CVS, and DEQ prepared the BHHRA for the BSS, and the document was finalized as a DEQ document in June 2010 (DEQ, 2010c). As part of the BHHRA, DEQ developed SSCLs, including a qualitative evaluation of ecological risks. A site-specific fate and transport evaluation of how contaminants move through the soil to groundwater was also conducted using data gathered during the RI (DEQ, 2009b). In July 2010, DEQ prepared an addendum to the BHHRA that calculated off-site indoor air SSCLs for commercial and residential properties (DEQ, 2010d). In 2011, DEQ also prepared an addendum to the BHHRA to evaluate risks to on-site construction workers associated with inhalation of contaminated soil vapors (DEQ, 2011a).

Based on findings from previous investigations and the RI, DEQ finds that the data obtained is adequate for DEQ to evaluate and select an appropriate remedy for the BSS. However, during preparation of the ROD, DEQ noted that elevated PCE concentrations were detected in soil vapor samples collected along the entire length of the former sewer line behind the BSC building in 1996 (NE&W, 1999b). DEQ did not use this 1996 data in the BHHRA because it does not represent current conditions, and sampling and analysis methods have improved since the 1996 data was collected. As part of remedial design, soil vapor sampling along the former sewer area will be conducted to determine if COCs in soil vapor exceed the SSCLs. Based upon the results of the sampling, DEQ will determine if the SVE system needs to address that area.

The ROD contains cleanup levels for all known COCs, and addresses all media contaminated from the hazardous or deleterious substances released from or associated with the former dry cleaning operations at the BSC described herein.

The ROD documents the final remedy for the BSS; it addresses the principal threats to public health, safety, and welfare and the environment posed by contaminated media; and selects a remedy that will comply with applicable or relevant state and federal environmental requirements, criteria, and limitations (ERCLs).

DEQ anticipates that remedial design for portions of the remedy will begin shortly after the ROD is issued, and implementation or construction will begin in approximately one year. Institutional controls will be implemented during and/or after the construction phase of the remedy.

5.0 SITE CHARACTERISTICS

5.1 SITE CONCEPTUAL EXPOSURE MODEL (SCEM)

The SCEM (Figure 4) is the framework for understanding the receptors and exposure pathways included in the risk assessment and the way contaminants move in the environment. It identifies the primary sources located at the BSS as the leakage of contaminants from the septic system piping and tank and from joints and defects in the sewer line. Secondary sources include contaminated subsurface soils, soil vapor (including subslab soil vapor), and groundwater (Figure 5). Contaminants migrate from the soil to the groundwater and flow with the groundwater to form a contaminant plume. Contaminants may also volatilize from the soil and groundwater, forming vapors, which can move into overlying structures. These primary sources and migration pathways result in potential exposures for humans through drinking or using contaminated groundwater, breathing contaminated air inside buildings, or breathing contaminated air from utility or construction trenches and excavations.

5.2 BSS OVERVIEW

5.2.1 Geology

The majority of the BSS is situated upon a broad alluvial fan, known as the Bozeman-Fan Subarea, between the Gallatin Mountains to the south and the East Gallatin River alluvium to the north (Hackett, et al., 1960). The Bozeman-Fan Subarea deposits consist of complex layers of clay, silt, sand and gravel (NE&W, 1999b). The topography of the BSS primarily slopes north from the BSC to the East Gallatin River. The topography north of the East Gallatin River generally slopes southward (Hackett, et al., 1960).

The shallow lithology (less than 20 ft bgs) at the BSC, and extending north to about Oak Street, consists primarily of sand, gravel, and sand and gravel (NE&W, 1999b). From about Oak Street to the East Gallatin River, the shallow lithology consists primarily of a silt/clay-dominated unit, which ranges in thickness from 0 to 12 ft. Deep well logs confirm the presence of alternating

sequences of clay/clayey sand and gravel deposits to at least 325 ft bgs in the BSS area (GWIC, 2011). Well logs also indicate that there is little lateral or vertical continuity of individual units. Most individual deposit thicknesses are on the order of feet to tens of feet (NE&W, 1999b). The geology beneath the BSS ranges from a clay to cobble-sized material and is considered "uniformly heterogeneous." The organic content of soil less than 25 ft bgs ranges from 0.03% to 0.13% (NE&W, 1999b).

The primary soil groups that are most relevant to the BSS are the Blackdog (silty to silty clay loam), the Enbar (loam to very gravelly loam), and the Blossberg (loam to very gravelly loam) (NE&W, 1999b). The Blackdog is the most predominant of the soil groups immediately north of the BSC. Enbar is fairly predominant and correlates to natural drainage features within or near the BSS such as along Walton Ditch. Blossberg also correlates to natural drainage features. There is no soil classification for areas between the BSC and West Durston Road because of urbanization (NE&W, 1999b and NRCS, 2011).

5.2.2 Surface Water Hydrology

The East Gallatin River, two natural streams (Mandeville Creek and East Catron Creek), and three irrigation ditches, including Walton Ditch, Farmers Canal and Middle Creek Ditch, are located on or near the BSS (Figure 6) (USGS, 1994). As discussed in Section 5.2.3, these surface water bodies may interact with the groundwater system to varying degrees potentially altering the flow patterns of the contaminated groundwater plume (NE&W, 1999b).

The East Gallatin River transects the northern portion of the BSS. The river generally flows in a northwest direction (NE&W, 1999b and USGS, 1994). The only areas within the 100-year flood plain are adjacent to the East Gallatin River (FEMA, 1988).

Walton Ditch flows along the western and northern boundaries of the BSC property and generally through the center of the BSS. Walton Ditch originally conveyed irrigation water from Farmers Canal through the central portion of the BSS eventually connecting back with Farmers Canal north of Oak Street (NE&W, 1999b). The City compared historic Walton Ditch flow conditions to groundwater levels in adjacent monitoring wells to evaluate Walton Ditch's interaction with the groundwater system near the BSC (NE&W, 1999b). Losses of water from Walton Ditch to the groundwater system were highly variable ranging from no contribution during no-flow events up to several hundred gallons per minute (gpm) (NE&W, 1996b and 1999b). These losses lead to highly variable groundwater levels and temporarily reversed groundwater flow directions in the immediate vicinity of Walton Ditch, specifically at the BSC (Figure 7) (NE&W, 1996b).

The Walton Ditch diversion head gate from the Farmers Canal was removed when Farmers Canal was routed through subsurface piping as part of South 19th Avenue road improvements. Steady irrigation flows are no longer observed in Walton Ditch, and it currently transports primarily storm water discharges. Because of the reduction in flow, Walton Ditch's current and future contribution to groundwater is expected to be minimal (NE&W, 2011b).

5.2.3 Hydrogeology

Groundwater is present in a primarily unconfined aquifer of sand, gravel, and intermittent clayey and silty deposits (NE&W, 1999b). In general, depth to groundwater is approximately between three and 27 ft bgs with the shallower groundwater associated with localized confining conditions (ATC, 2011b). Groundwater contamination is between six and 130 ft bgs at the BSS (ATC, 2011b). Groundwater contamination has not been detected in wells where groundwater is three ft bgs. Historically, the depth to groundwater at the BSS can change by up to 14 ft between high groundwater conditions and low groundwater conditions. High seasonal groundwater conditions generally occur in early summer (June) and low groundwater conditions generally occur in winter (December) (ATC, 2011b).

Domestic water supply wells, including residential and commercial are located adjacent to and within the BSS at various depths (Figure 8). The regional groundwater flow is generally from south to north on the south side of the East Gallatin River (Figure 9) (NE&W, 1999b and ATC, 2011b). The groundwater flow on the north side of the East Gallatin River tends to be to the northwest paralleling the River to the north (NE&W, 2011c).

The groundwater in the area of the East Gallatin River interacts with the East Gallatin River and a series of natural streams and irrigation ditches at the BSS. During periods of high flow (e.g. spring runoff), a surging East Gallatin River likely loses significant surface water to the underlying aquifer system causing localized variations in groundwater flow direction near the river (NE&W, 2005). Historic water level measurements and flow conditions indicate that during periods of high flow, Walton Ditch at the BSC caused temporary groundwater flow direction reversals and groundwater mounding (Figure 7). This change in flow direction did not appear to last long, and eventually the groundwater flow returned to its general south to north direction (NE&W, 1996b).

Surface water and irrigation water also contribute to the groundwater flow beneath the BSS. The primary recharge source during the summer is a result of irrigation water seeping into the ground from the numerous ditches crossing the surface of the Bozeman Fan and the infiltrating irrigation water applied to the fields (Hackett, et al. 1960). Certain portions of the irrigation water are lost through evaporation and evapotranspiration, and some is lost as surface water flow. In addition to recharge from precipitation and irrigation, some natural streams likely contribute recharge water to the subsurface as well (NE&W, 1999b).

Pumping test data indicate the average hydraulic conductivity to be about 51.5 feet per day (ft/day). Slug test data showed hydraulic conductivity ranges from approximately 7 to 145 ft/day. Hydraulic conductivity calculated from slug tests is similar in magnitude to hydraulic conductivity calculated from pumping tests. However, the use of those values leads to flow and transport rates that appear to be too low to explain historic water quality observations in residential and monitoring wells at BSS. Observations of a "pulsing" behavior associated with seasonal recharge losses from Walton Ditch appear to correlate with variations in water quality in certain monitoring wells. Based on this "pulsing" behavior, hydraulic conductivities were estimated to be between 125 ft/day and 900 ft/day. In addition to "pulsing," stratigraphic heterogeneity in the saturated zone may cause the different hydraulic conductivities observed at the BSS (NE&W, 1999b).

In 2010, the specific conductance of the groundwater at the BSS ranged from 398 to 1761 MicroSiemens per centimeter (µS/cm) (ATC, 2011b). Administrative Rules of Montana (ARM) 17.30.1006(1) identifies groundwater that has a natural specific conductance of less than 1000 µS/cm at 25 degrees C [Celsius] as Class I, which is suitable with little or no treatment for public and private water supplies, culinary and food processing purposes, irrigation, livestock and wildlife watering, and for commercial and industrial purposes with little or no treatment. ARM 17.30.1006(2) identifies groundwater that has a natural specific conductance of greater than 1,000 and less than or equal to 2,500 µS/cm at 25 degrees C as Class II, which is at least marginally suitable for public and private water supplies, culinary and food processing purposes, irrigation of some agricultural crops, drinking water for livestock and wildlife, and most commercial and industrial purposes. Based on specific conductance measurements and that the groundwater requires little or no treatment to maintain its beneficial uses, DEQ has determined the BSS groundwater is classified as Class I.

5.3 BSS CONTAMINATION

DEQ evaluated data collected prior to the RI, during the RI, and subsequent to the RI to: (1) identify sources of contamination; (2) determine the extent of contamination in soils, groundwater, surface water, sediment, soil vapor, and indoor air; (3) determine risks to human health and the environment; and (4) develop and evaluate cleanup options. During the pre-RI, RI, and post-RI investigations, groundwater samples (over 1500), surface soil samples (approximately 19), subsurface soil samples (approximately 240), surface water samples (approximately 36), sediment samples (approximately 11), soil vapor samples (over 100), and indoor air samples (approximately 90) were collected. When discussing sampling, DEQ refers to sampling conducted at or on the BSC property as “on-site” and sampling off the BSC property as “off-site.”

The findings of the investigations are summarized below. Additional information regarding concentrations for individual chemicals detected in surface water and sediment can be found in the RI (NE&W, 1999b).

5.3.1 Groundwater

Groundwater at the BSS is contaminated with chlorinated solvents, primarily PCE (Figure 10). Trichloroethene (TCE), *cis*-1,2-dichloroethene (DCE), and vinyl chloride have also been detected in groundwater at the BSS. TCE, DCE, and vinyl chloride are not contaminants released from the former dry cleaner, but are degradation breakdown products, or daughter products, of PCE (NE&W, 1999b).

In 1989, DEQ conducted a survey of public water supplies in Montana and, as part of that survey, collected a groundwater sample from a public water supply well approximately 2,200 ft north of the BSC (NE&W, 1999b and 2011d). PCE was detected in this well at 714 µg/L, which exceeded the MCL/DEQ-7 standard of 5 µg/L (DEQ, 1989). Subsequent investigations identified elevated concentrations of PCE, TCE, or DCE in the BSC septic tank area, along the former sewer line at the BSC, and in groundwater samples from drinking water and irrigation wells down gradient from the BSC (PRC, 1994b, NE&W, 1999b, DEQ, 2011k).

Historically, the highest levels of PCE (4,780 µg/L), TCE (146 µg/L), and DCE (519 µg/L) were detected in the groundwater adjacent to the former sewer line at the BSC (ATC, 2011b). The MCL/DEQ-7 standard for TCE is 5 µg/L and the MCL/DEQ-7 standard for DCE is 70 µg/L. In some on-site wells, PCE concentrations fluctuate up and down depending upon groundwater levels BSC (ATC, 2011b).

PCE was detected at 2.8 µg/L in M-42 a monitoring well installed on the south side of the Hastings Book Store retail space at the BSC, after subslab soil vapor samples collected from Hastings detected PCE up to 32,000 µg/m^3 (ATC, 2011b and Kleinfelder, 2010b). PCE concentrations in M-42 indicate that PCE contamination moved in the opposite direction of normal groundwater flow at the BSC.

Following an enhanced bioremediation pilot test in 2008, vinyl chloride was detected in the groundwater at a maximum concentration of 247 µg/L in a well adjacent to the former septic tank area (ATC, 2010a). Vinyl chloride was not detected in the groundwater before the pilot test. Vinyl chloride was also detected in a downgradient off-site monitoring well (M-23) at 0.77 µg/L. The MCL and DEQ-7 standard for vinyl chloride is 2 µg/L and 0.2 µg/L, respectively. In June 2010, vinyl chloride still exceeded the MCL and DEQ-7 standard adjacent to the treatment area, but was less than the MCL in June 2011 (ATC, 2011b and ATC, 2011d).

Table 6 presents the occurrence of COCs in the groundwater at the BSS. The PCE contaminated groundwater plume is estimated to be about 1.7 billion gallons. The maximum depth of PCE detected in the groundwater at the BSS is 130 ft (NE&W, 2011d). PCE concentrations increase in the deeper portions (greater than 50 ft depth) of the aquifer as groundwater flow moves north towards the East Gallatin River (ATC, 2011b).

5.3.2 Soil

Subsurface (greater than 2 ft bgs) soil samples were collected throughout the BSC prior to, during, and subsequent to the RI. Surface (0-2 ft bgs) soil sampling was limited to the area along the northwestern water line installation project (Canonie, 1993a). Surface soil samples were not collected on-site because the PCE releases were associated with the former sewer line and septic system area, which are greater than six feet deep (NE&W, 1999b). There are no known contaminated surface soils at the BSS. According to the RI Report, the maximum concentrations of PCE, TCE, and DCE in on-site subsurface soils were 20,000 milligrams per kilogram (mg/kg), 110 mg/kg, and 150 mg/kg, respectively, along the former sewer line (Figure 11) (NE&W, 1999b). An SVE system was installed in 1995 along the former sewer line to clean up the PCE, TCE, and DCE on-site subsurface soil contamination (Figure 12) (NE&W, 1999b). Confirmation soil samples were collected in 2010 from SVE remediated areas along the former sewer line where releases were identified. These samples showed that concentrations were less than SSCLs, indicating the SVE system was successful in remediating PCE, TCE and DCE soil contamination in this area (Figure 13) (ATC, 2010b). PCE, TCE, and DCE have not been detected in off-site soils (NE&W, 1999b).

NE&W (1999b) identified saturated zone (beneath the groundwater table) contamination in the area of the former septic tank system and connecting manhole (identified as Zone 5 – see Figure 2), and extending west-southwest along the former sewer line (NE&W, 2011d). The on-going PCE contamination to the groundwater plume indicates that DNAPL contamination likely exists within the saturated zone soil and continues to dissolve into the groundwater (NE&W, 1999b and NE&W, 2011d). DNAPL contamination tends to exist as disconnected ganglia, or small discontinuous accumulations of DNAPL, and/or collects in the soil pore structure and/or in lower permeability strata such as clay lenses (Cohen and Mercer, 1993). This ganglia or associated soil contamination has the potential to leach, or dissolve, and cause groundwater contamination (NE&W, 1999b and Pankow, et al., 1996). The on-site residual source area includes the saturated soil contamination. The on-site residual source area also has the potential to volatilize in the unsaturated zone (ITRC, 2003).

Table 7 presents the occurrence of COCs in subsurface soil at the BSS. The volume of soil potentially containing residual COC in the saturated zone at Zone 5 is estimated to be 7,220 cubic yards based on the surface area and estimated depth of saturated contamination at Zone 5, but not including any over-excavation or excavation required to access the impacted soils (NE&W, 2011d).

5.3.3 Surface Water and Sediment

During the RI, surface water and sediment samples were collected from Walton Ditch, Farmers Canal, the East Gallatin River, an unnamed spring between the East Gallatin River and the North 19th Avenue and I-90 interchange, and Cherry Springs near the northern end of North 7th Avenue (Figure 6) (NE&W, 1999b). PCE was detected in the Farmers Canal, the East Gallatin River, the unnamed spring, and Cherry Springs during this sampling. Only the sample from the unnamed spring had PCE exceeding the DEQ-7 surface water standard (5 µg/L). PCE was detected at 20 µg/L in the unnamed spring. PCE has been detected in the unnamed spring during annual sampling, but has not exceeded the DEQ-7 standard since 2003 (ATC, 2011b). In June 2011, PCE was detected at 1.5 µg/L (ATC, 2011d). Table 8 presents the occurrence of COCs in surface water at the BSS. PCE was not detected in sediment samples collected from the water bodies described above (NE&W, 1999b).

5.3.4 Soil Vapor

The highest levels of PCE (4,100 micrograms per cubic meter [$\mu g/m^3$]) and TCE (7.6 $\mu g/m^3$) detected in off-site soil vapor samples were at 5 and 11.5 ft bgs, respectively. DCE and vinyl chloride were not detected in off-site soil vapor samples (Kleinfelder, 2010a). The highest PCE concentration in groundwater in the area of the off-site soil vapor investigation at the time the off-site soil vapor samples were collected was 11 µg/L at monitoring well M-8 (ATC, 2011b) (Figure 14). TCE was not detected in off-site groundwater when off-site soil vapor samples were collected (ATC, 2011b).

The highest concentrations of PCE, TCE, and DCE detected in on-site soil vapor (excluding subslab soil vapor) were 1,600 $\mu g/m^3$, 56 $\mu g/m^3$, and, 0.765 $\mu g/m^3$, respectively, at a depth of 10.5 ft bgs (Kleinfelder, 2010). See Figure 14. Table 9 presents the occurrence of COCs in soil

vapor at the BSS. Table 9 includes soil vapor results collected in November 1996 and included in the RI (NE&W, 1999b). DEQ did not use this 1996 data in the BHHRA because it does not represent current conditions, and sampling and analysis methods have improved since the 1996 data was collected. However, this data indicates that elevated concentrations of PCE in soil vapor (up to 9,000 $\mu g/m^3$) were present along the entire length of the former sewer line behind the BSC building (NE&W, 1999b and DEQ, 2011s). Soil vapor data collected during the enhanced bioremediation pilot test was not included in Table 9 because the pilot test temporarily changed contaminant concentrations that are not representative of overall site conditions. In addition, an SVE system was in place to address these soil vapor contaminants during the pilot test (ATC, 2010d).

Vinyl chloride was not detected in on-site soil vapor, except in the area of the enhanced bioremediation pilot test, where it was detected at concentrations greater than 4,600 $\mu g/m^3$ in a soil vapor probe immediately downgradient of the treatment area (ATC, 2010d). During the enhanced bioremediation pilot test, vinyl chloride and methane were generated and detected in on-site soil vapor. Both vinyl chloride and methane concentrations exceeded the pilot test trigger concentrations (10 times baseline and 25% of the lower explosive limit [LEL] or 12,500 parts per million [ppm], respectively) requiring the concentrations to be addressed by an SVE system. Two years after the pilot test, methane concentrations exceeded 25% of the LEL every seven to 10 days (ATC, 2011a). The SVE system is operated for up to six hours every seven to 10 days to reduce the methane concentrations below 25% of the LEL (ATC, 2011a). Soil vapor monitoring following the pilot test has included methane field measurements, but not vinyl chloride analysis (ATC, 2010d and 2011a).

5.3.5 Indoor Air

Indoor air samples were collected from on-site and off-site locations after the RI (Figures 15a, 15b, 15c, and 16). The highest PCE and TCE levels detected in on-site indoor air were 11 and 0.63 $\mu g/m^3$, respectively. DCE and vinyl chloride were not detected in on-site indoor air. PCE was detected at a maximum concentration of 32,000 $\mu g/m^3$ (HBS-SV-5) in the soil vapor subslab sample collected immediately beneath the concrete slab of the on-site building (Kleinfelder, 2010b). See Table 10 for the occurrence of COCs in on-site indoor air at the BSS and Table 11 for off-site indoor air results.

The presence of PCE vapors beneath the BSC subslab may be the result of PCE volatizing from historically elevated PCE concentrations in contaminated soil and/or groundwater and the soil vapor moving beneath the BSC building and becoming trapped. Alternatively, PCE contaminated groundwater may have flowed underneath the building due to influences from surface water losses from Walton Ditch creating a temporary reversal in groundwater flow direction where dissolved PCE may have become adsorbed to the soil matrix beneath the BSC building. When groundwater flow direction returned to normal, PCE began volatilizing from the soil matrix (DEQ, 2011a). See Table 12 for the occurrence of COCs in on-site subslab soil vapor at the BSS and Table 13 for off-site subslab soil vapor.

The highest PCE concentration detected in off-site subslab soil vapor samples was 360 $\mu g/m^3$ in location 17-512 (Kleinfelder, 2010a). The highest PCE concentration in groundwater in the

investigation area at the time the off-site sub-slab samples were taken was 14 µg/L (M-8 in December 2008) (ATC, 2011b).

The highest PCE level detected in off-site indoor air was 36 µg/m^3. Based on the presence of a brake cleaner product in the residence that contained PCE (Kleinfelder, 2010b), DEQ determined the indoor air levels were associated with an indoor PCE source (DEQ, 2010a). DEQ also determined that TCE, DCE and vinyl chloride were not COCs for off-site indoor air because these contaminants were not detected above screening levels in off-site soil vapor samples (DEQ, 2009d; Kleinfelder, 2009b; DEQ, 2010c). Therefore, TCE, DCE and vinyl chloride were not analyzed in off-site indoor air samples (Kleinfelder, 2010a).

6.0 CURRENT AND REASONABLY ANTICIPATED FUTURE LAND AND RESOURCES USES

6.1 LAND USES

The majority of the BSS is within the Bozeman city limits in Gallatin County, Montana. The current land use within and adjacent to the BSS is zoned a mixture of light manufacturing, business, residential, and agricultural (BCCPO, 1997). The BSC is currently zoned community business (Bozeman, 2009). Examples of business and light manufacturing in the area include retail stores, restaurants, business offices, gasoline stations, and motels. In addition, there are over 100 residential properties immediately north of the BSC (Kleinfelder, 2010a).

Recently, the City and the area within the BSS have been experiencing rapid growth and development. Much of this growth results from the construction of the North 19th Avenue Interstate 90 Interchange where previously undeveloped land was converted into a major transportation corridor with associated commercial land use (Bozeman, 2009).

DEQ also evaluates present use of property through information provided by landowners, site inspections, and information provided by liable parties in the remedial investigation or other documents. For example, the RI Report (NE&W, 1999b), the BHHRA (DEQ, 2010c), and the FS (NE&W, 2011d) provided descriptions of current and future land use of the BSS. Current use can also be determined during a site visit. DEQ conducted a site visit and observed how the BSC and the nearby properties are being used.

DEQ determined reasonably anticipated future use by assessing the four factors outlined in Section 75-10-701(18), MCA: 1) local land and resource use regulations, ordinances, restrictions, or covenants; 2) historical and anticipated uses of the facility; 3) patterns of development in the immediate area; and 4) relevant indications of anticipated land use from the owner of the facility and local planning officials. To evaluate (1), (2), and (3), DEQ reviewed the current zoning for the BSC (Bozeman, 2010b), which is currently B-2 (Community Business). DEQ also reviewed the Bozeman City-County Planning Office's Master Plan for the North 19th Avenue/Oak Street Corridor (Master Plan) (BCCPO, 1997). In addition, DEQ reviewed the information in Section 2.1 to identify historical uses of the BSC. Based on this

review, DEQ found that the current land use at the BSS includes commercial, light industrial, residential, and agricultural. The Master Plan indicates the agricultural uses will be transformed into commercial, light manufacturing, and residential uses (BCCPO, 1997).

To identify the "relevant indications of anticipated land use from the owner of the facility," DEQ sent letters on November 10, 2010, and March 23, 2011, to RMRG Portfolio, LLC, requesting information on its anticipated future land use of the BSC property (DEQ, 2010g; DEQ, 2011r). DEQ did not receive a response to either letter. Therefore, DEQ evaluated this factor primarily with reference to the Master Plan (BCCPO, 1997) as well as other available information, including the June 30, 2004, Declaration of Covenants, Conditions, Restrictions and Reciprocal Easements which contains specific permitted uses and prohibited uses, including a prohibition on "living quarters" at the BSC (Declaration, 2004).

Based on all information evaluated, DEQ determined that the reasonably anticipated future use of the BSS is commercial, light industrial, residential, and agricultural, although it is likely that the agricultural uses will be transformed into commercial, light industrial, and residential uses. DEQ also determined that the reasonably anticipated future use of the BSC is commercial/industrial.

6.2 GROUNDWATER USES

A 1993 well inventory identified 125 domestic wells, including residential, business, and public supply wells, within and adjacent to the BSS (PRC, 1994b). As part of the RI, a well inventory update was conducted to identify new or previously unidentified wells that are being used for domestic purposes. A database search at the DNRC was done for the areas in which new construction was observed (Section 25-1S-5E, Section 25-1S-6E and Section 26-1S-5E). A physical survey and house-to-house survey were conducted to verify and supplement information obtained from the database search (NE&W, 1999b). In 2005, a water well inventory update was conducted (Maxim, 2005b). This well inventory identified 179 wells. A comprehensive well inventory for all monitoring wells, residential wells, industrial wells, and public water supply wells at the BSS is provided on Table C-1 in 2010 Annual Groundwater Monitoring Report for the BSS (ATC, 2011b).

At the time of the RI Report, the area north of West Oak Street was not served by municipal water. Groundwater was the primary drinking water source for residences and businesses north of West Oak Street. As the City municipal water lines extended to the north, new residences and business connected to the City municipal water. As required by DEQ's order WQ-93-101, and subsequent amendments, the City and CVS have connected residences and businesses within the BSS whose drinking water wells have PCE concentrations that exceed the DEQ-7 standard (5 µg/L). Currently, 10 residences/businesses south of the East Gallatin River have not been connected to alternate municipal water (e.g. City water) because the PCE concentrations in their respective wells have not exceeded 5 µg/L (Figure 17) (ATC, 2011b). The BSS extends to an area north of the East Gallatin River where City municipal water is not currently available. This area consists of developed residential subdivisions. The Old Farm subdivision consists of about 11 lots of which 9 currently have existing residences that utilize private wells (NE&W, 2011d).

6.2.1 DNRC CGWA

On July 20, 1998, DNRC promulgated a final Order establishing the BSS CGWA (DNRC, 1998). The boundary of the CGWA depicts the outer limits of the plume as interpreted at the time the CWGA Order was issued, extended by an additional 1,000 ft and does not represent the extent of the dissolved plume itself (Figure 1). The key components of the CGWA include:

- Designation of the boundaries of the CGWA; and
- Establishment of a well drilling and installation permit system.

The Order prohibits the drilling and installing of water wells within the CGWA boundaries without first obtaining an interim permit from DNRC. DNRC will not issue provisional permits where one or more of the following conditions exist:

1. The proposed well is located within the projected limit of highest contamination (greater than 100 μg/L) determined from ongoing groundwater monitoring.
2. Groundwater pumping from the individual well, or in combination with existing or proposed wells nearby, is likely to induce or redirect contaminated groundwater plume migration.
3. A water supply from the City is presently available or will be available for use by the time the proposed project is to be completed.
4. The proposed well has a design capacity equal to or greater than 1,000 gpm.

If none of the conditions exists, DNRC may issue an interim permit to install a Type A or Type B well. DNRC defines Type A wells as wells that withdraw a maximum of 35 gpm and do not exceed 10 acre-feet of water per year within the CGWA. DNRC defines Type B wells as wells that withdraw greater than 35 gpm, or exceed 10-acre feet of water per year within the CGWA.

After the well is installed and before DNRC issues a provisional permit, the CGWA Order provides that DEQ or a designated representative will sample the well for COCs at no direct cost to the permit applicant. If PCE concentrations exceed 5 μg/L, the CGWA Order requires the permit applicant to consult with DEQ to determine the applicant's eligibility for installation of a water treatment unit at no cost to the applicant. If the PCE concentrations are less than 5 μg/L, the well owner is required to provide a dedicated space to accommodate installation of a water treatment system, if groundwater conditions change in the future (DNRC, 1998).

6.3 SURFACE WATER USES

As discussed in Section 5.2.2, the surface water within the BSS includes the East Gallatin River, natural streams and irrigation ditches (see Figure 6). ARM 17.30.610 classifies the East Gallatin River from the Montana Highway No. 411 (Spring Hill Road) crossing to Dry Creek, about five miles east of Manhattan, as B-2. Waters classified B-2 are to be maintained suitable for drinking, culinary, and food processing purposes, after conventional treatment; bathing, swimming, and recreation; growth and marginal propagation of salmonid fishes and associated aquatic life, waterfowl and furbearers; and agricultural and industrial water supply (ARM 17.30.624).

Mandeville Creek and East Catron Creek have not been classified. These creeks likely are used for swimming, recreation, and growth and marginal propagation of aquatic life, waterfowl, and furbearers. Mandeville Creek intersects and receives flow from the Farmers Canal (NE&W, 1999b).

Historically, the irrigation ditches have diverted and conveyed water to farmlands for irrigation purposes (NE&W, 1999b). As stated in Section 5.2.2, the Walton Ditch diversion head gate from the Farmers Canal was removed and steady irrigation flows are no longer observed. Walton Ditch currently transports storm water discharges. The use of the Farmers Canal and the Middle Creek Ditch as irrigation conveyances are likely to decrease as well due to the growth and development that the City is experiencing.

7.0 HUMAN HEALTH AND ECOLOGICAL RISK ANALYSIS

The BHHRA assessed the current and potential future risk to human health that may be associated with exposure to contaminated subsurface soil, soil vapor, surface water, groundwater, and indoor air under specific conditions that are consistent with current and reasonably anticipated future land uses (DEQ, 2010c). A site-specific fate and transport model to evaluate soil contamination leaching to groundwater evaluation was also conducted using data gathered during the RI (DEQ, 2009b). During the BHHRA, the contaminants of potential concern (COPCs), exposure pathways, exposure assumptions, and toxicity values were identified, and SSCLs were calculated for COCs. In July 2010, DEQ prepared an addendum to the BHHRA that calculated off-site indoor air SSCLs for commercial and residential properties (DEQ, 2010d). In 2011, DEQ also prepared an addendum to the BHHRA to evaluate risk to on-site construction workers associated with inhalation of contaminated soil vapors (DEQ, 2011a).

In the BHHRA, DEQ compared the COC concentrations at the BSS with the SSCLs and DEQ-7 standards (DEQ, 2010c and DEQ, 2011a). Based upon this evaluation, DEQ determined that the COC concentrations in subsurface soil, soil vapor, and groundwater at the BSS represent unacceptable risks to human health and the environment, and that remediation is necessary.

The remedial actions selected in this ROD are necessary to protect public health, safety, and welfare and the environment from actual or threatened releases of hazardous or deleterious substances into the environment and to abate the imminent and substantial endangerment those releases pose.

7.1 HUMAN HEALTH RISKS

Current and reasonably anticipated future use of the BSS was evaluated as part of the risk assessment. The current land use at the BSS includes commercial, light industrial, residential, and agricultural. As stated in Section 6.1, the reasonably anticipated future use of the BSS is the same, although the North 19th Avenue/Oak Street Corridor Master Plan (Master Plan) indicates the agricultural uses will be transformed into commercial, light manufacturing, and residential uses (BCCPO, 1997).

Populations that could be exposed to contamination at the BSS include current and future on-site workers and visitors, on-site and off-site utility workers and construction workers, off-site agricultural workers, and off-site residents and workers (DEQ 2010c, 2010d, and 2011a). These populations have the potential to contact contaminants through their skin from contaminated groundwater; ingest contaminated groundwater; or inhale contaminated soil vapor. In the BHHRA, DEQ determined that the groundwater to on-site workers/visitors exposure pathway does not need to be quantitatively evaluated because potential exposures will be addressing using DEQ-7 standards (DEQ, 2010c). DEQ-7 standards are developed to protect the designated beneficial uses of state waters (DEQ, 2010e). In addition, DEQ determined that the exposure pathway of off-site residents and workers inhaling volatiles released into the air from showering or bathing in contaminated groundwater is not complete because no one within the BSS is using the groundwater that exceeds DEQ-7 standards or MCLs for domestic purposes (drinking or showering) (DEQ, 2010c). DEQ did quantitatively evaluate the potential exposures to on-site and off-site utility and construction workers and off-site agricultural workers. A SCEM is provided in Figure 4.

In the BHHRA and the July 2011 addendum, DEQ calculated potential cancer risk and potential non-cancer effects for skin contact of subsurface soil and groundwater, incidental ingestion of subsurface soil and groundwater, and inhalation of subsurface soil vapors (DEQ, 2010c and 2011a). COPCs were identified by their detection frequency and exceedance of screening levels. COPCs were then separated based on their effect (i.e., cancer causing or non-cancer effects). Hazard quotients were calculated for non-carcinogenic effects based on target organs or critical effects to ensure that the total hazard index did not exceed 1 for any organ or effect. Cancer risks were calculated to ensure that the total excess lifetime cancer risk did not exceed a one in 100,000 individual excess lifetime cancer risk (1×10^{-5}). "Excess lifetime cancer risk" is additional risk that someone might have of getting cancer if that person is exposed to cancer-causing compounds at the BSS. DEQ considers an additional or excess 1 in 100,000 chance (or 0.001% or 0.00001 or 1×10^{-5}) allowable (based on legislative directions in Section 75-5-301(2)(b)(i)), MCA). A summary of the calculation of cancer risk estimates and non-cancer hazard indices for each receptor/medium/pathway combination with the exception of the inhalation of indoor air is provided in Table 14. For the receptor/medium/exposure pathway combinations that yielded cancer risks exceeding 1×10^{-5} or non-cancer hazard index of 1.0, SSCLs were calculated as discussed in Section 7.1.1.

The most recent toxicity information available was used to calculate risk levels (DEQ, 2010c). If toxicity information is updated, DEQ may recalculate potential cancer risks or non-cancer effects for COCs. If DEQ recalculates potential cancer risks or non-cancer effects for COCs, DEQ will determine whether a modification to the ROD is required by generally following the procedures outlined in EPA's Guide to Preparing Superfund Proposed Plans, Records of Decisions, and Other Remedy Selection Decision Documents (EPA, 1999b). This guidance document provides various options for documenting changes to the ROD, depending on the nature of the modification. Specifically, options may include preparing a memorandum to the file, an explanation of significant difference (ESD), and a ROD amendment. DEQ will determine if additional public comment is required based upon the specifics of any modification.

DEQ did not calculate potential cancer risk and potential non-cancer effects for the on-site or off-site vapor intrusion pathway because of the extreme variability inherent in this pathway and the number of factors influencing indoor air concentrations. Rather, in order to be protective and conservative, DEQ calculated SSCLs that consider the cumulative effects for all COCs attributable to vapor intrusion in all on-site and off-site commercial and residential buildings. Indoor air SSCLs were back-calculated from a cumulative cancer risk limit of 1 $x10^{-5}$ or a non-cancer hazard quotient of 1.0 (DEQ, 2010c and 2010d). SSCLs are further discussed in Section 7.1.1.

7.1.1 Determination of COCs

DEQ determined which COPCs should be retained from the data presented in the RI and subsequent investigation reports to become COCs. PCE is the primary COC for the BSS in on-site subsurface soil (leaching to groundwater), on-site and off-site soil vapor, and on-site and off-site groundwater. PCE is also a COC for indoor air. PCE's degradation breakdown products, TCE and DCE (EPA, 1998c), are also COCs in soil for leaching to groundwater. TCE is a COC for on-site and off-site soil vapor. TCE, DCE, and vinyl chloride, also a PCE degradation breakdown product (EPA, 1998c), were generated in groundwater and soil vapor during a bioremediation pilot test (ATC, 2010a). Two years after the pilot test, methane concentrations exceeded 25% of the LEL every seven to 10 days (ATC, 2011a). Vinyl chloride was not identified as a COPC during the risk assessment because it was not detected at the BSS prior to the enhanced bioremediation pilot test. Because vinyl chloride concentrations exceeded the DEQ-7 standard more than two years after the pilot test, and enhanced bioremediation is the selected remedy for the residual on-site source, vinyl chloride is retained as a COC for groundwater and soil vapor (ATC, 2011a and 2011d). In addition, DEQ retained methane as a COC based on its persistence in soil vapor following the pilot test.

7.1.1.1 Health Effects and Hazards

Health effects of PCE, TCE, DCE, and vinyl chloride are discussed below:

- PCE: PCE is a manufactured chemical that is widely used for dry cleaning of fabrics and for metal-degreasing. It is also used to make other chemicals and is used in some consumer products. At high vapor concentrations, PCE can cause numbness and heart attacks. Medical studies of workers exposed to PCE have not shown increased death rates. Although total death rates were not increased, increased death rates from cancers of the lungs, cervix, uterus, and skin were found. Animal studies show that PCE can cause liver and kidney damage. The liver is a target organ in humans accidentally exposed to high concentrations of PCE. The U.S. Department of Health and Human Services (DHHS) has determined that PCE may reasonably be anticipated to cause cancer (ATSDR, 1997a).

  EPA has been evaluating the toxicity of PCE for many years. The toxicity values for PCE that DEQ used in the BHHRA and addendums are those that EPA has provided in its Regional Screening Levels (RSL) table (EPA, 2009a) and are based on IRIS (1988), ATSDR (1997a), and California EPA (2008). The RSL table was updated in December 2009, May 2010, November 2010, February 2011, May 2011, and June 2011, but none of these updates

affected the toxicity information used in the BHHRA (EPA, 2011c). These RSL tables are currently used throughout the country to screen for contaminants at Superfund facilities. In June 2008, EPA released the draft Toxicological Review of Tetrachloroethylene (Draft Toxicological Review) for external peer review (EPA, 2008b). The Draft Toxicological Review addresses both non-cancer and cancer human health effects that may result from chronic exposure to PCE, and is an update of an existing assessment posted on IRIS in 1988. The toxicity values in the Draft Toxicological Review differ from those that EPA used to develop the RSLs. Specifically, the draft Toxicological Review includes a chronic reference concentration (RfC) and carcinogenicity assessment, which are not currently available on IRIS, as well as an update of the 1988 IRIS reference dose (RfD). The Draft Toxicological Review is still in draft form and includes language stating that the document has not been formally disseminated by EPA and should not be cited or quoted as EPA determination or policy (EPA, 2008b). The final toxicological review document is expected to be completed during the 4th quarter of federal fiscal year 2011 (e.g. June – September 2011) (EPA, 2011b). Once EPA releases the final Toxicological Review of Tetrachloroethylene, DEQ will recalculate potential cancer risks or non-cancer effects for COCs using the updated toxicological information. If the current SSCLs are not protective of human health based on the revised toxicity information, DEQ will determine whether a modification to the ROD is required as described in Section 7.1, and if additional public comment is required based upon the specifics of any modification.

- TCE: TCE is a manufactured chemical and not thought to occur naturally in the environment. However, it has been found in underground water sources and many surface waters as a result of the manufacture, use, and disposal of the chemical. TCE can also be a breakdown or daughter product of PCE under certain conditions. TCE is used mainly as a solvent to remove grease from metal parts, but it is also an ingredient in adhesives, paint removers, typewriter correction fluids, and spot removers. Drinking large amounts of TCE may cause nausea, liver damage, unconsciousness, impaired heart function, or death. Drinking small amounts for long periods may cause liver and kidney damage, impaired immune system function, and impaired fetal development in pregnant women. Skin contact with TCE for short periods may cause skin rashes. Some studies of people exposed over long periods to high levels of TCE in drinking water or workplace air have found evidence of increased cancer. The National Toxicology Program determined that TCE is "reasonably anticipated to be a human carcinogen." The International Agency for Research Cancer has determined that TCE is "probably carcinogenic to humans" (ATSDR, 1997b).

- DCE: DCE is a manufactured chemical used in chemical mixtures and to produce solvents. DCE can also be a breakdown or daughter product of PCE and TCE under certain conditions. Limited studies have been conducted evaluating the health effects caused by DCE. Animals that ingested extremely high doses of DCE died. Lower doses of DCE caused effects on the blood, such as decreased numbers of red blood cells, and also effects on the liver. The EPA has not determined if DCE causes cancer (ATSDR, 1996).

- Vinyl chloride: Vinyl chloride is a manufactured substance that does not occur naturally. Vinyl chloride is used to make a variety of plastic products, including pipes (polyvinyl chloride – PVC), wire and cable coatings, and packaging materials. It can also be formed

when other substances such as PCE and TCE are degraded. Studies in workers who have breathed vinyl chloride over many years showed an increased risk of liver, brain, lung, and blood cancers. Some people who work with vinyl chloride have nerve damage and develop immune reactions. Some workers exposed to very high levels of vinyl chloride have problems with the blood flow in their hands. The effects of drinking high levels of vinyl chloride are unknown. Vinyl chloride will cause numbness, redness, and blisters if spilled on the skin. The DHHS has determined that vinyl chloride causes cancer (ATSDR, 2006).

Hazards related to methane vapor or gas are discussed below:

- Methane is a naturally occurring gas that is colorless and odorless. It is produced during bacterial decomposition of organic material in an anaerobic or oxygen-depleted environment. It is sometimes associated with landfills or other man-made activities that artificially create oxygen-depleted conditions, such as chemical releases. Methane tends to move upward toward the ground surface because it is lighter than air. If upward movement is inhibited, by a cap such as asphalt, methane tends to migrate horizontally along the path of least resistance to other areas where it can resume its upward path. Methane can travel through utility corridors. If methane collects in a confined space, such as a manhole, a subsurface space, a utility room in a home, or a basement, it could potentially explode at certain concentrations. The concentration level at which a gas, like methane, has the potential to explode is called the explosive limit. The potential for a gas to explode is determined by its LEL and upper explosive limit (UEL). Methane is explosive between its LEL of 5% by volume (50,000 ppm) and its UEL of 15% by volume (150,000 ppm). At concentrations below its LEL and above its UEL, methane is not explosive. Methane can create explosive conditions if allowed to collect in confined spaces, such as utility rooms, in overlying buildings, or manholes (ATSDR, 2001).

7.1.2 Calculation of Cleanup Levels

The following sections provide a discussion of COCs for each media and a discussion of the calculation of SSCLs, and the established regulatory cleanup levels. These cleanup levels will establish acceptable levels that are protective of human health associated with exposure to soil vapor and groundwater, and protective of the environment by minimizing the migration of contaminants into the groundwater from soil. For human health, DEQ allows cleanup levels to be calculated based on cumulative risk levels less than or equal to a total excess cancer risk of 1x10-5 for carcinogens or a total hazard index less than or equal to 1 for non-carcinogens. For the environment, soil cleanup levels must be adequately protective to ensure leaching to groundwater does not exceed DEQ-7 water quality standards.

7.1.2.1 Groundwater

The Montana Board of Environmental Review (BER) has enacted rulemaking to establish water quality standards for protection of human health pursuant to Section 75-5-301, MCA. Montana's numeric groundwater quality standards (DEQ-7 standards) are the applicable cleanup level for groundwater (DEQ, 2010e). When evaluating drinking water alternatives, DEQ also considered the use of MCLs, as those are the federal standards generally applied to public drinking water

supplies. However, the MCL for PCE, which is the only COC currently found in drinking water wells, is the same as the DEQ-7 standard, so DEQ-7 will be referenced hereafter. The cleanup level for PCE in groundwater is provided in Table 1. Because there is a potential for the generation of TCE, DCE, and vinyl chloride in groundwater while conducting the selected remedy, as evidenced by their presence in groundwater following the enhanced bioremediation pilot test, the DEQ-7 standards for these compounds are also included in Table 1.

7.1.2.2 Soils

DEQ developed SSCLs that are protective of DEQ-7 standards for the subsurface soil contaminants that may leach to groundwater at the BSS (DEQ, 2009b). The COCs for leaching to groundwater are provided in Table 2 along with their corresponding SSCLs. August 2010 soil sample results indicate that soils along the former sewer line where soils were treated with an SVE system were less than the SSCLs (ATC, 2010b). However, soil contamination may still be present in the saturated zone, below the SVE system treatment area. This soil contamination has the potential to leach and cause groundwater contamination exceeding DEQ-7 standards.

7.1.2.3 Soil Vapor

DEQ calculated SSCLs for inhalation of soil vapor for on-site utility workers, and on-site and off-site construction workers using equations developed by EPA (EPA, 2009b). Different SSCLs were calculated for utility workers and construction workers based on different exposure assumptions (amount of time expected to be exposed to contamination). The on-site and off-site construction worker is assumed to spend more time exposed to contaminated soil vapors during construction activities for new developments or buildings (DEQ, 2010c and 2011a). The on-site utility worker is assumed to be exposed for a shorter period of time while working on buried utility lines on-site than a construction worker. Therefore, the construction worker SSCLs are more conservative, or lower, than the on-site utility worker SSCLs. The area of soil vapor contamination that exceeds the SSCLs is shown on Figure 18 and is approximately 148,994 square feet (sq ft). The area shown on Figure 18 includes the former sewer line behind the BSC building to the former dry cleaner service line. This area is expanded from the area shown in the Proposed Plan (DEQ, 2011b) to include the area where PCE was detected in November 1996 at sample VS-14 (9,000 $\mu g/m^3$) (NE&W, 1999b and DEQ, 2011s).

Table 3 lists the COCs for soil vapor and their corresponding SSCLs. Table 4 provides the cleanup criteria for on-site subslab soil vapors. The SSCLs calculated for soil vapor are based on assumptions protective of a construction or utility worker in a trench or excavation. These SSCLs are not protective of indoor air as a result of vapor intrusion; for those SSCLs, see the Indoor Air section below.

DEQ did not calculate SSCLs for methane. Instead, DEQ used 25% of the LEL (12,500 ppm) as the methane level requiring action to be taken to reduce concentrations (Table 3). DEQ established 25% of the LEL as the cleanup level for methane based on ARM 17.50.1106(1)(a) and (b). ARM 17.50.1106(1)(a) and (b) requires the owner or operator of a Class II landfill to ensure that the concentration of methane gas generated by the facility does not exceed 25% of the LEL for methane.

7.1.2.4 Indoor Air

DEQ calculated indoor air SSCLs using equations developed by EPA (EPA, 2009b). Table 5 lists the cleanup levels for PCE in indoor air. On-site and off-site indoor concentrations do not currently exceed SSCLs. However, elevated concentrations of PCE (32,000 $\mu g/m^3$) were detected in the subslab soil vapor beneath the BSC building. The contaminated on-site subslab soil vapor poses a potential future risk of indoor air SSCL exceedences if the BSC building is remodeled, the heating, ventilation, and air conditioning (HVAC) system changes, or the building's concrete slab is damaged or degraded (NJDEP, 2005; NYSDOH, 2006; MADEP, 2007; ITRC, 2007a; DTSC, 2009; NJDEP, 2010; and DEQ, 2011b).

7.1.3 Evaluation of Uncertainties

This section evaluates uncertainties associated with the BHHRA and addendums (DEQ 2010c, 2010d, and 2011a), which are discussed below.

- Investigations have been conducted for soil, soil vapor, indoor air, groundwater, and surface water/sediment at the BSS. COPC concentrations and distributions in soil, soil vapor, indoor air, groundwater, and surface water/sediment appear to be adequately characterized. While unlikely, it is possible that unidentified data gaps exist, and COPCs may be screened out and therefore not evaluated as COCs as a result.

- Exposure point concentrations in the BHHRA were calculated using EPA's statistical computer program, ProUCL (EPA, 2007a). ProUCL provides a statistical analysis of non-detect data to determine the best fit for the given data set and then makes the appropriate adjustments to represent non-detect concentrations in the overall risk calculations. Calculating the 95% or 97.5% Upper Confidence Level (UCL) for detected and non-detected concentrations may result in an over-estimate of actual concentrations and an over-estimate of the cancer risk and non-cancer hazard indices.

- For exposure pathways involving on-site and off-site groundwater, the maximum groundwater concentrations were used. Use of the maximum concentration may over-estimate actual exposures and result in over-estimates of the cancer risk and non-cancer hazard indices.

- For on-site vapor inhalation by utility and construction workers in a trench or excavation, the maximum concentrations of PCE and TCE were used as the medium specific exposure point concentrations because the limited soil vapor data (number of samples) could not be statistically evaluated. Use of the maximum concentration may over-estimate actual exposures and result in over-estimates of the cancer risk and non-cancer hazard indices.

- Exposure assumptions are based on values published in EPA guidance documents (EPA, 1989). Since these variables are all multiplied together, they tend to add conservatism and will likely yield an over-estimate of actual exposure conditions. In addition, professional judgment was used in the selection of estimates for exposure frequency and duration of most

of the exposure pathways evaluated. The values selected are expected to yield over estimate of the actual exposures that may occur within the boundaries of the BSC or in the off-site portion of the BSS.

In general, the available scientific literature is insufficient to provide a thorough understanding of potential toxic properties of chemicals to which humans are exposed. Therefore, it is necessary to infer these properties by extrapolation from data obtained under other conditions of exposure, usually from experimental laboratory animals. This introduces two types of uncertainties into the risk evaluation: (1) the uncertainty of extrapolating from one species to another; and (2) the uncertainty related to extrapolating from the high exposure doses usually employed in experimental animal studies to lower doses usually estimated for human environmental exposures. The development approach EPA applies to cancer slope factors and non-cancer reference doses likely results in an over estimate of the actual risk to humans. Because of the conservatism or uncertainty inherent in the non-cancer reference dose, a hazard quotient or hazard index greater than 1.0 does not necessarily mean that an adverse effect will occur (DEQ, 2010c and 2011a).

7.2 ECOLOGICAL RISK EVALUATION

The BSS is largely within a commercial/residential land use zone and no significant ecological resources have been identified at the facility. No animal species of special concern have been identified within a four-mile radius of the BSS (NE&W, 1999b). Lastly, COCs do not exceed water quality standards or ecological toxicity thresholds in surface water features. Therefore, cleanup levels protective of human health will likely be protective of any ecological receptor's limited exposure. Since there are no significant ecological resources at the facility, conducting an ecological risk assessment was not warranted (MSE, 2001 and DEQ, 2010c).

7.3 CHEMICAL FATE AND TRANSPORT MODEL

As part of the BHHRA, DEQ performed chemical fate and transport modeling to develop SSCLs for the soil leaching to groundwater pathway at the BSS (DEQ, 2009b). The SSCLs were back-calculated using the DEQ-7 standards for PCE, TCE, and DCE. A soil leaching to groundwater SSCL was not calculated for vinyl chloride because it has not been detected in soils (NE&W, 1999b). The presence of vinyl chloride in the groundwater is the result of the enhanced bioremediation pilot test (ATC, 2010d).

The SSCLs based on soil leaching to groundwater are concentrations of COCs in subsurface soils that are protective of DEQ-7 standards. The modeling was performed to predict COCs concentrations in groundwater directly beneath the residual contaminated soil source area. The COCs and corresponding SSCLs computed for the soil leaching to groundwater pathway are provided in Table 2. A discussion of the calculation of the soil leaching to groundwater SSCLs can be found in the BHHRA.

7.4 REGIONAL FATE AND TRANSPORT GROUNDWATER MODEL

A numerical fate and transport (F&T) model was used to simulate changes in the dissolved PCE groundwater plume over time and to estimate the amount of time it will take some remedial alternatives to comply with DEQ-7 standards (see Table 15). This F&T model used established three-dimensional groundwater flow and contaminant F&T parameters. The regional F&T model only applies to the off-site groundwater plume because the resolution of the model cells is too large to represent localized concentrations near historic source areas or residual sources (NE&W, 2011d).

There are inherent uncertainties associated with the cleanup timeframes predicted by the F&T model. These uncertainties include subsurface geology, geologic heterogeneity, aquifer parameters, recharge from precipitation, losses from surface water, source mass (before/after remediation), contaminant distribution, retardation of contaminants in the aquifer, etc. Predictions provide a useful metric for comparative evaluation of alternatives; for example, the time to achieve DEQ-7 standards for the different alternatives. A detailed discussion of the F&T model development and predictions is provided in the FS (NE&W, 2011d).

8.0 REMEDIAL ACTION OBJECTIVES

DEQ identified Remedial Action Objectives (RAOs) for each contaminated medium (DEQ, 2011b). RAOs are general descriptions of what the remediation must accomplish in order to protect public health, safety, and welfare and the environment against unacceptable risk identified in the BHRRA and addendums, consistent with reasonably anticipated land use and beneficial use of groundwater. As discussed in Section 7.0, the BHRAA and the addendums identified unacceptable risks to on-site utility and construction workers and off-site construction workers for inhalation of soil vapors. In addition, the BHHRA and addendums calculated SSCLs for on-site and off-site commercial and residential indoor air, as well as SSCLs for soil that are protective of leaching to groundwater. Groundwater SSCLs are the DEQ-7 standards. Using the RAOs, DEQ identified and screened remedial alternatives that will achieve protection of public health, safety, and welfare and the environment consistent with reasonably anticipated future land use and beneficial use of groundwater.

RAOs were not developed for surface water or sediment as there are no COCs present in sediment or surface water that exceed screening levels. RAOs were not developed for ecological receptors because there are relatively few ecological receptors at the BSS, and the cleanup levels protective of human health will also reduce any limited ecological exposure that may occur.

8.1 GROUNDWATER

The following RAOs are defined for groundwater at the BSS:

- Meet groundwater cleanup levels for COCs in groundwater throughout the BSS.
- Comply with applicable and relevant ERCLs for COCs in groundwater.
- Reduce potential future migration of the contaminated groundwater plume.

- Prevent exposure of humans to COCs in groundwater at concentrations above SSCLs.
- Reduce volatilization of COCs from groundwater that would exceed soil vapor SSCLs or indoor air SSCLs.

8.2 SOIL

The following RAOs are defined for soil at the BSS:

- Meet soil cleanup levels for COCs.
- Prevent migration of COCs that would potentially leach from soil to groundwater.
- Reduce volatilization of COCs from soil that would exceed soil vapor SSCLs or indoor air SSCLs.

8.3 SOIL VAPOR

The following RAOs are defined for soil vapor at the BSS:

- Meet soil vapor cleanup levels for COCs.
- Prevent exposure of humans to COCs in soil vapor at concentrations above SSCLs.

8.4 INDOOR AIR

The following RAOs are defined for indoor air at the BSS:

- Prevent exposure of humans to COCs in indoor air at concentrations above SSCLs.

8.5 ON-SITE SUBSLAB SOIL VAPOR

The following RAOs are defined for soil vapor at the BSS:

- Reduce the potential for subslab soil vapors to move upward and impact indoor air at concentrations greater than the SSCL in the BSC building.

9.0 DESCRIPTION OF ALTERNATIVES

A brief description of the cleanup alternatives presented in the FS (NE&W, 2011d) and evaluated by DEQ are set forth below.

9.1 COMPONENTS OF ALTERNATIVES

All remedial alternatives, except No Further Action, have site-wide elements. These site-wide elements are described here and are not repeated in the descriptions of alternatives that follow. These elements include institutional controls, engineering controls, and long-term monitoring. The following assumptions are provided for the site-wide elements.

Institutional controls. Institutional controls are non-engineering measures, such as administrative or legal controls, that help minimize the potential for human exposure to contamination and protect the integrity of a remedy by limiting land or resource use. Although institutional controls do not remediate the contamination at the BSS, they can be effective for managing human exposure to contaminants. The effectiveness of institutional controls depends on the mechanisms used and the durability of the institutional control. Institutional controls may be layered to improve effectiveness. Institutional controls are considered easy to implement and inexpensive to implement and maintain. Specific institutional controls that are necessary at the BSS are listed below.

Land Use Controls: Pursuant to Section 75-10-701(18), MCA, DEQ determined reasonably anticipated future use by assessing these four factors: 1) local land and resource use regulations, ordinances, restriction, or covenants; 2) historical and anticipated uses of the facility; 3) patterns of development in the immediate area; and 4) relevant indications of anticipated land use from the owner of the facility and local planning officials. (See Section 6.1)

Based on this evaluation, DEQ determined that the current and reasonably anticipated future use of the BSC is commercial/industrial. Therefore, DEQ developed SSCLs for the BSC based on this use and, as part of the final remedy, DEQ is requiring that all of Lot 1 and that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs (Figure 18) be restricted to commercial/industrial use. This restriction is consistent with the Declaration of Covenants, Conditions, Restrictions and Reciprocal Easements previously placed on the BSC property on June 30, 2004, by the Bozeman Shopping Center, LLC, which indicate that "permitted uses" of the BSC are "retail sales and services, or other related commercial uses" and "prohibited uses" of the BSC include, but are not limited to, mobile home parks, trailer courts, hotels, motor inns, living quarters, sleeping apartments, or lodging rooms (Declaration, 2004). The prohibition on "living quarters" indicates that the property owner has already restricted residential use at the property. As provided in Section 75-10-727, MCA, DEQ will require these restrictions to continue through use of a DEQ-approved restrictive covenant in substantially the same form as the documents found in Appendix C. If COC concentrations are reduced to levels that allow unrestricted use of the property in the future, Section 75-10-727(4), MCA, provides for lifting of the institutional control.

In addition, DEQ is requiring that no construction or development of structures occurs on the northwest corner of Lot 2. DEQ is requiring this restriction because this is the residual source area where active treatment (enhanced bioremediation) will occur. Construction or development in this area may interfere with the active treatment. This restriction is limited to the time of active treatment; once the active treatment is complete, the restriction can be removed.

Groundwater Use Restrictions: The remedy partially relies on the existing CGWA to limit the installation of wells within or adjacent to the area of contamination associated with the BSS to protect human health and limit migration of contaminants.

Permitting Requirements: Requirements to provide fresh air mechanical ventilation during construction or trench activities are needed to protect utility and construction workers from inhalation of soil vapors in certain areas at the BSS. In the FS (NE&W, 2011d), the City indicated it could require a provision of fresh air mechanical ventilation for construction/utility excavations and trenches at the BSC and properties immediately north of the BSC to provide additional protection as part of its existing trench/excavation construction permit system. The construction trench and excavation permit system will require fresh air mechanical ventilation in construction trenches or excavations on Lots 1 and 2 of the BSC, the eastern edge of 1608 West Beall Street, 1602 West Beall Street, the southeast corner of 1605 West Beall Street, the southwest corner of 302 North 16th Avenue, and the City right-of-way associated with the intersection of West Beall Street and North 16th Avenue (see Figure 26). The City can require permit applicants to limit their open trench lengths, and most permitted trenches do not exceed 100 ft (ATC, 2011c and NE&W, 2011d). Therefore, a 100 foot long trench was the maximum length modeled (Trihydro, 2011). The permit system would apply to trenches of 100 ft or less in length and would require an appropriately sized blower to provide adequate ventilation. The trench and excavation dimensions are described in Section 11.2.1.2. Trenches greater than 100 ft in length may require additional ventilation (Trihydro, 2011). The permit system will be required to ensure protection of construction or utility workers until COC concentrations in soil vapors are below the SSCLs.

Restrictive covenants and the permit requirements will be in effect until DEQ determines they are no longer needed to ensure protection of human health. For the CGWA, DEQ will notify DNRC when groundwater SSCLs are met and this ROD is fully implemented.

Long-term Monitoring. Monitoring is a common element to all remedial alternatives. However, the monitoring requirements may vary for each remedial alternative. The general objective of monitoring is to evaluate the effectiveness of the remedy and to ensure the ongoing protection of public health, safety and welfare and of the environment.

The long-term monitoring program for the BSS will include sampling of the existing monitoring well network that now includes 114 wells (Figure 8), or any additional wells that may be installed during remedial design or under the CGWA Order. Monitoring will also include some or all of the existing nearby residential or commercial/industrial wells to ensure that nearby public water supply and private drinking water wells do not become contaminated above DEQ-7 standards. Sampling for Exhibit B wells (Figure 17) will also be incorporated into the monitoring program. At a minimum, monitoring of selected wells will be conducted on a semi-annual basis during high and low groundwater elevations for the first five years and at a reduced frequency thereafter, until cleanup levels are achieved. Details of the required monitoring will be developed after the ROD is issued.

City Water Connections. DEQ Water Quality Order WQ-93-101, and subsequent amendments, requires the City and CVS to provide an alternate municipal water supply to all residences and businesses within the BSS whose drinking water wells have PCE concentrations that exceed the DEQ-7 standard (5 μg/L). The following requirements of that order are integrated into the ROD as follows.

Currently, 10 residences/businesses south of the East Gallatin River have not been connected to alternate municipal water (e.g. City water) because, although detected, the PCE concentrations have not exceeded 5 µg/L (Figure 17); these wells are referred to as Exhibit B wells. The remedy requires that, if PCE concentrations in any of these wells meet or exceed 5 µg/L as identified by groundwater monitoring, the City and CVS provide bottled water to the residence or business within five business days of receipt of the preliminary sample results. The City and CVS are also required to resample the affected well within ten business days of receipt of the preliminary sample results. If the confirmation sample has a PCE concentration that meets or exceeds 5 µg/L, the City and CVS must continue providing bottled water and must connect the affected property to City water within 90 calendar days of receipt of the confirmation sample results. This connection must be provided to the residences and businesses without a charge for installation costs and hook-up costs and fees, although the City may install a water meter and thereafter charge the individual water users for the water provided to the water user's residence or business. In addition, at the time a residence or business is connected to City water, the well must be disconnected so that it is not available for domestic purposes. The well may continue to be used for non-domestic uses such as irrigation, agricultural, stock, or industrial/commercial process water, although the City and CVS are not required to reconnect the well to service those uses.

If the confirmation sample does not contain a PCE concentration that meets or exceeds 5 µg/L, the City and CVS may discontinue providing bottled water and the well must be returned to its regular sampling schedule within six months of the confirmation sample. DEQ may also require more frequent sampling if DEQ determines it is necessary based upon the results of the sampling.

This requirement also applies if PCE degradation products (TCE, DCE, and vinyl chloride) meet or exceed their respective MCL/DEQ-7 standards.

9.1.1 Alternative 1 – No Action

The No Action Alternative provides a baseline against which other options are compared. No further cleanup or monitoring is considered under this alternative. Contamination would remain on-site and would continue to cause exceedences of SSCLs on-site and off-site. DEQ would no longer enforce WQ- 93-101 requiring the City and CVS to provide alternate water. In addition, DNRC may no longer enforce the CGWA Order that limits the use of groundwater in the BSS. Thus, people would continue to be exposed to contamination exceeding DEQ-7 standards.

9.1.2 Alternative 2 – In situ Enhanced Bioremediation (On-site Residual Source)

In situ (in place) bioremediation is a process which involves the delivery of an organic substrate into the subsurface for the purpose of stimulating microbial growth and development, creating an anaerobic groundwater treatment zone, and generating hydrogen through fermentation reactions (ESTCP, 2004). PCE undergoes reductive dechlorination under anaerobic conditions (ESTCP, 2004). Reductive dechlorination occurs when a hydrogen atom replaces a chlorine atom of the PCE molecule. For example, PCE degrades to TCE, which degrades to DCE, which in turn degrades to vinyl chloride. Figure 19 shows the reductive dechlorination process of PCE to

ethene (Geomega, 2005). Although vinyl chloride is generally more susceptible to breaking down in aerobic conditions (EPA, 1998c), it can be dechlorinated to ethene under sulfate reducing or methanogenesis conditions (ITRC, 1998).

Enhanced bioremediation of saturated zone soil and groundwater would reduce contaminant concentrations of PCE in on-site groundwater and soil enhancing dissolution from DNAPL or enhanced desorption of PCE mass sorbed to the soil matrix (ESTCP, 2004). This may increase the effectiveness of enhanced bioremediation to treat DNAPL sources, such as ganglia, by enhancing the mass transfer of the PCE mass to aqueous phase, where it is more subject to biodegradation processes (ESTCP, 2004). However, PCE breakdown products may be generated in the groundwater as discussed below. If the elevated subslab PCE vapors beneath the BSC building are the result of residual PCE contamination entrained in the soil beneath the building or trapped vapors, this alternative will not address PCE in the subslab soil vapor.

As COC concentrations in the saturated soil and groundwater decrease, the COC concentrations in the soil vapor will likely be reduced. However, methane and vinyl chloride may be generated in the soil vapor as discussed below (ATC, 2010d), and would be addressed using an SVE system. If the elevated subslab PCE vapors beneath the BSC building are the result of residual PCE contamination entrained in the soil beneath the building or trapped vapors, this alternative will not address PCE in the subslab soil vapor and would not be protective of indoor air.

Enhanced anaerobic bioremediation has been successfully applied at sites with residual or sorbed DNAPL (e.g. ganglia). Sites have been closed based on complete dechlorination of PCE to ethene and ethane and residual concentrations of breakdown products (i.e., TCE, DCE and vinyl chloride) below MCLs (ESTCP, 2004). An enhanced bioremediation pilot test conducted at the BSC in 2008 demonstrated that in situ enhanced biodegradation can reduce PCE concentrations in the on-site shallow (<40 ft bgs) groundwater (ATC, 2010d). However, the pilot test generated methane, TCE, DCE, and vinyl chloride in soil vapor. In addition, TCE, DCE, and vinyl chloride were generated in the groundwater at concentrations exceeding the DEQ-7 standards. The presence of methane indicates that the oxygen in the treatment area was reduced to anaerobic conditions. The presence of vinyl chloride indicates that there was incomplete dechlorination of the PCE (ESTCP, 2004).

During the pilot test, the methane in soil vapor exceeded 25% of the LEL and vinyl chloride concentrations exceeded 10 times the baseline requiring vapors be mitigated through an existing SVE system (ATC, 2010d). Based on recent monitoring, methane concentrations exceeding 25% of the LEL are still being generated two years after the pilot test ended. These methane concentrations are currently mitigated every seven to 10 days using the SVE system (ATC, 2011a).

The pilot test generated vinyl chloride in the groundwater at concentrations exceeding the DEQ-7 standard of 0.2 μg/L. Vinyl chloride had not been detected in the groundwater prior to the pilot test (ATC, 2010a). Vinyl chloride still exceeded the DEQ-7 standard in December 2010 (ATC, 2011b), two years after the pilot test, indicating the PCE was still being reduced (dechlorinated). Once the vinyl chloride moved downgradient of the treatment area and into the high oxygen environment, the vinyl chloride was oxidized and concentrations decreased (EPA,

1998c; ATC, 2010d; ATC, 2011b; ATC, 2011d; and ATC, 2011e). However, vinyl chloride was detected in M-23, located approximately 150 ft downgradient of the treatment zone, at 0.77 μg/L in December 2009, a year after the pilot test. Vinyl chloride was not detected (less than 0.2 ug/L) in this well in June 2011 (ATC, 2011e).

As DNAPL ganglia dissolves, PCE concentrations in the groundwater may rebound following the enhanced bioremediation substrate application (ESTCP, 2004). If present, PCE rebound will be identified during performance monitoring. If PCE rebound is observed, additional applications of substrate can be used to continue the anaerobic reduction conditions.

9.1.3 Alternative 3 – In situ Chemical Oxidation (On-site Residual Source)

In situ chemical oxidation (ISCO) involves injection of a chemical oxidant into the saturated zone to destroy contamination in groundwater and saturated soils, including intermittently saturated soils (EPA, 2001c). Chemical oxidation converts hazardous contaminants to non-hazardous, less toxic constituents, such as chloride, carbon dioxide, and water. The two most critical success factors for ISCO are the effective distribution of the oxidant in the treatment zone and the reactivity of a particular oxidant with the contamination present. Common oxidants used include permanganate, sodium persulfate, calcium peroxide, hydrogen peroxide, and ozone, among others. All of these oxidants have shown to be effective in remediating PCE (ITRC, 2005a).

ISCO of saturated zone soil, including PCE ganglia, and groundwater would reduce contaminant concentrations of PCE in on-site groundwater and soil, without generating PCE daughter products, such as vinyl chloride or methane (ITRC, 2005a). ISCO is also expected to reduce COC concentrations in the soil vapor as it remediates COCs in the saturated soil and groundwater. Some oxidants can directly breakdown DNAPL (ITRC, 2000). If the elevated subslab PCE vapors beneath the BSC building are the result of residual PCE contamination entrained in the soil beneath the building or trapped vapors, this alternative will not address PCE in the subslab soil vapor, and would not be protective of indoor air.

Chemical oxidation has been shown to be effective at treating PCE at other sites, although it is often used at sites with higher concentrations (e.g. mg/L concentrations) (ITRC, 2005a). Some chemical oxidants can release unwanted by-products, such as sulfate, manganese, chromium, and arsenic (EPA, 2006b), and can pose health and safety risks to remediation workers because most oxidants are corrosive and can burn the skin and are incompatible with certain materials (ITRC, 2005a). The byproducts and health and safety risks can generally be addressed by oxidant choice, application methods, and appropriate health and safety measures. The lithology at the BSC and limitations of direct push equipment may limit the ability of applying the oxidant via direct push injection points (NE&W, 2011d). Direct push equipment refers to tools and sensors that are "pushed" into the ground without the use of drilling to remove soil or to make a path for the tool (Geoprobe, 2011). As stated above, effective distribution of the oxidant through the treatment area is a critical factor in ISCO success. If the oxidant cannot be injected using direct push equipment, injection wells installed with air rotary or hollow stem auger drilling equipment could be used. The use of conventional injection wells would significantly increase the cost (NE&W, 2011d).

9.1.4 Alternative 4 – Air Sparging (On-site Residual Source)

Air sparging involves injecting air into the saturated zone (groundwater) to volatilize (turn into vapor or gas) contaminants absorbed to saturated soils and dissolved in groundwater (EPA, 1998a and 2001b). Volatilized contaminants migrate to the unsaturated zone, or vadose zone, above the groundwater in air bubbles (EPA, 1994b).

Chlorinated solvents, such as PCE, easily volatilize and can be cleaned up when they are dissolved in the groundwater using an air sparging system (EPA, 1998a; EPA 2001b; Batelle, 2001; and Herron et. al., 2002). This alternative is expected to reduce PCE concentrations in the groundwater in the treatment area. However, PCE absorbed to saturated soils or present as ganglia is more resistant and will continue to dissolve into the groundwater (Pankow, et al, 1996). Air sparging would address the PCE once it is dissolved in the groundwater, but not PCE absorbed to the soil (Herron, et al., 2002). PCE concentrations in on-site soil vapor may increase initially as PCE is volatilized from the saturated zone. An SVE system is used to extract the soil vapor. SVE is a presumptive remedy for volatile organics in soil (EPA, 1993b) and no pilot test would be necessary to determine its effectiveness. However, a pilot test to optimize the effectiveness of the SVE would be necessary to design the system. In addition, the contaminated vapors would be treated prior to discharge to the atmosphere. If the elevated subslab PCE vapors beneath the BSC building are the result of residual PCE contamination entrained in the soil beneath the building or trapped vapors, this alternative will not address PCE in the subslab soil vapor, and would not be protective of indoor air.

9.1.5 Alternative 5 – On-Site Hydraulic Control/Containment (On-site Residual Source)

On-site hydraulic control or containment, also called pump and treat includes pumping, treating, and then discharging the groundwater. This alternative will treat groundwater from the on-site residual source and minimize the downgradient movement of groundwater contaminated by the on-site residual source material (EPA, 1996d and 1996e). PCE concentrations in the soil vapor will reduce over time as PCE concentrations decrease in the groundwater. If the elevated subslab PCE vapors are the result of residual PCE contamination entrained in the soil or trapped vapors, this alternative will not address PCE in the soil vapor, and would not be protective of indoor air.

An extraction system would be used to remove contaminated groundwater from the aquifer before it moves off the BSC. Extraction well placement within the residual source area (Zone 5) would be considered hydraulic control. Extraction well placement downgradient of the residual source zone would be considered hydraulic containment. Once extracted, contaminated groundwater would be treated and discharged or reinjected into the aquifer or discharged to the surface water. Due to the depth of groundwater contamination (depths greater than 20 ft bgs) at the BSC, specialized equipment would be needed to install recovery trenches. Trench drains are typically constructed using a backhoe to shallow depths in heterogeneous, low permeability media and many wells would be needed to obtain the required yield for capture of a specific area (EPA, 1997d and WDNR, 2003). Once extracted, ex-situ treatment of groundwater can be accomplished a number of ways, including carbon adsorption, among other options. Carbon adsorption is a technology in which groundwater is pumped through activated carbon (liquid or solid) to adsorb organic contaminants, such as PCE, from the groundwater.

Pump and treat systems can be compromised by a number of factors related to the COCs and characteristics of the site. Specifically, a progressively slower rate of dissolved contaminant concentration decline is often seen with continued pump and treat operations. Another problem with pump and treat systems is that dissolved contaminant concentrations may "rebound" if pumping is discontinued (EPA, 1994a, 1996d, 1996e, 1997d, and 2002b).

On-site ex-situ treatment of groundwater via carbon adsorption would significantly reduce the amount of contaminated groundwater migrating to the off-site portions of the BSS. Pump and treat is a presumptive remedy for contaminated groundwater (EPA, 1996e) and no pilot test was necessary to determine its effectiveness. However, a pilot test would be necessary to optimize design of the system.

9.1.6 Alternative 6 – Passive Soil Venting (Soil Vapors)

Passive soil venting removes contamination, in the form of vapors, from the soil above the water table. Passive soil venting could remove volatile contaminants from the soil vapor, including subslab soil vapor beneath the BSC building, and discharge the vapors to the atmosphere. Extraction by passive soil venting is driven by natural pressure gradients between the subsurface and atmosphere (barometric pumping), or by renewable sources of energy such as wind or solar power. The use of passive venting is more appropriate at sites where the residual source quantities are low (Kamath, et al., 2009), for remote sites, or as a polishing step following aggressive remediation (ACE, 2002).

On-site passive soil venting would reduce contaminant concentrations in the soil vapor at the BSC. To ensure that subslab soil vapors throughout the BSC building footprint are addressed, passive vent points may have to be installed inside the building, in addition to along the building perimeter. Contaminated vapors removed by passive soil venting are not treated before being discharged to the atmosphere because there is little available driving pressure to push contaminated vapors through the treatment equipment (ACE, 2002). This alternative does not address the on-site residual source material or the off-site dissolved plume.

9.1.7 Alternative 7 – Soil Vapor Extraction (Soil Vapors)

SVE removes contamination, in the form of vapors, from the soil above the water table (EPA, 2001b). The vapors are extracted (removed) from the ground by applying a vacuum, treated, and discharged to the atmosphere. SVE has been used on-site in the past and reduced PCE concentrations in the soil and groundwater (NE&W, 1999a).

This alternative would be designed to reduce contaminant concentrations in the soil vapor and subslab soil vapor beneath the BSC building. To ensure that subslab soil vapors throughout the BSC building footprint are addressed, SVE points may have to be installed inside the building, in addition to along the building perimeter. Once the SVE system pulls the air and vapors out of the ground, air pollution control equipment separates the clean air from the contaminated vapors. The contaminants are absorbed onto activated carbon while the clean air is discharged into the atmosphere (EPA, 1996a). The activated carbon is then disposed of in accordance with applicable regulations.

Prior application of SVE at the BSC showed an SVE radius of influence (ROI) ranging from 40 to over 100 ft based on vacuum exceeding 0.1 inches of water in measured points. In an October 1996 test of the SVE along the former sewer line, vacuum was observed at a vapor well located greater than 100 ft from the vertical extraction well where two 4-horsepower blowers were pulling soil vapors from the ground. SVE operations conducted during the bioremediation pilot test had a ROI up to 80 ft from the horizontal extraction point using a 2-horsepower blower (NE&W, 2011d).

The ROI of an SVE application depends on (NE&W, 2011d):

1) Applied vacuum at extraction point (function of applied energy [horsepower]);
2) Permeability of subsurface (tighter soils increase energy losses and reduce ROI);
3) Type of extraction point (e.g., horizontal or vertical and placement and length of screen, etc.); and
4) Source of replacement air (Short circuits tend to reduce the ROI. Sealed surfaces limit short circuits and tend to increase the ROI.)

At the time of the operation of the City's SVE system in the 1990s, the back alley behind the BSC building was not paved but it has since been paved. The building has a concrete slab foundation. The front of the BSC building is mostly paved, but has some unpaved landscaped areas. In consideration of actual site experience and data, costs for the subslab SVE alternative were based on using equipment necessary to achieve a 100-foot ROI (NE&W, 2011d).

Depending on the SVE system's ROI, soil vapor outside of the building footprint will also be reduced, including contaminated soil vapor along the former sewer line. SVE is a presumptive remedy for volatile organics in soil (EPA, 1993b) and no pilot test would be necessary to determine its effectiveness. However, a pilot test to optimize the effectiveness of the SVE would be necessary to design the system.

This alternative does not address the on-site residual source material or the off-site dissolved plume.

9.1.8 Alternative 8 – New or Deeper Replacement Drinking Water Wells (Off-site Alternate Drinking Water)

Under this alternative, domestic water wells located north of the East Gallatin River, where City water services are not currently available, would be replaced with new or deeper wells if existing wells are contaminated with PCE at concentrations greater than the DEQ-7 standard. One deeper replacement well has already been installed at a property north of the East Gallatin River. The original well, R-57, was constructed to a depth of 80 ft. The replacement well, R-57R, was constructed to a depth of 120 ft (Maxim, 2005a). Recent groundwater monitoring indicates that PCE is present in R-57R, and PCE concentrations are increasing (ATC, 2011b). The groundwater fate and transport model predicts that five parcels, developed and undeveloped, north of the East Gallatin River, are potentially threatened by PCE contaminated groundwater (NE&W, 2011d).

New or deeper drinking water wells would be installed in uncontaminated portions (deeper than 180 ft) of the aquifer. Groundwater fate and transport modeling predictions and local lithology indicate that contamination is unlikely to reach this depth (NE&W, 2011d). As a precautionary measure, the new or deeper drinking water wells will be installed with special grouting and sealing to minimize any potential for vertical contaminant migration. The new or deeper drinking water wells would be monitored to ensure that water from these wells meets DEQ-7 standards.

This alternative does not address contamination in the groundwater, soil vapor, or the on-site residual source material.

9.1.9 Alternative 9 – Point-of-Use Treatment Systems (Off-site Alternate Drinking Water)

Under this alternative, domestic water wells that are contaminated with PCE at concentrations greater than the DEQ-7 standards would be temporarily treated with a point-of-use treatment system. Treatment would continue until permanent alternate drinking water becomes available or until standards are met. This alternative is specifically for the area north of the East Gallatin River where City water services are not currently available and for lots shown on Figure 20.

This alternative by itself protects human health by providing alternate drinking water so long as the treatment can remove contaminants and no breakthrough of contamination occurs. However, the protectiveness of this alternative is dependent upon the proper operation and maintenance of the point-of-use systems. Monitoring (e.g., PCE, coliform and bacteria) of the point-of-use treatment systems is required to ensure the effectiveness of the systems (EPA, 1985; DEQ, 2004a and 2004b). DEQ does not generally consider point-of-use treatment systems a long-term remedy (DEQ, 2004a and 2004b).

9.1.10 Alternative 10 – Connection to City Water (Off-site Alternate Drinking Water)

Under this alternative, domestic water wells that are contaminated with PCE at concentrations greater than the DEQ-7 standards would be replaced with City water services. This alternative is specifically for the area north of the East Gallatin River where City water services are not currently available. City water services have already been provided to impacted residences and businesses on the south side of the East Gallatin River, and will be provided to future impacted residences and businesses on the south side of the East Gallatin River if PCE concentrations exceed the standards. (See discussion in common elements for more information on impacted residences and businesses on south side of the East Gallatin River).

This alternative does not address contamination in the groundwater, soil vapor, or address on-site residual source material.

9.1.11 Alternative 11 – New Community Water System (Off-site Alternate Drinking Water)

Under this alternative, domestic water wells that are contaminated with PCE at concentrations greater than the DEQ-7 standards would be replaced with a new community water supply that is different from the City water services. This alternative is specifically for the area north of the East Gallatin River where City water services are not currently available. This alternative assumes that the water system may be classified as a community water supply as defined by ARM 17.38.101(3)(l), as the covenants on the Old Farm Subdivision allow a relatively large home and a guest house on each lot (Declaration, 1999); therefore, the total number of users may exceed 25 persons.

This alternative does not address contamination in the groundwater, soil vapor, or address on-site residual source material.

9.1.12 Alternative 12 – Plume Migration Control Pump and Treat (Off-site Dissolved Groundwater Plume)

This alternative consists of hydraulic containment designed to minimize the movement of PCE contaminated groundwater beyond the area presently served by City water (i.e., north of the East Gallatin River). Hydraulic containment, also called pump and treat, is a combination of collection, treatment, and discharge used to treat groundwater from the on-site residual source and to minimize the downgradient movement of groundwater contaminated by the on-site residual source material (EPA, 1996d and 1996e). Pumping wells would be placed in the off-site dissolved groundwater plume on the south side of the East Gallatin River. This alternative is a combination of groundwater extraction, ex situ treatment, and discharge or reinjection. This alternative may also reduce groundwater contaminant levels in this portion of the plume.

An extraction system is used to remove contaminated groundwater from the aquifer, followed by treatment, and discharge to surface water or reinjection into the aquifer. Due to the depth of groundwater contamination at the BSC (greater than 20 ft bgs), recovery trenches would require specialized equipment to install. Trench drains are typically constructed using a backhoe to shallow depths in heterogeneous, low permeability media where many wells would be needed to obtain the required yield for capture of a specific area (EPA, 1997d and WDNR, 2003). Two pumping well alignments were developed and evaluated using the F&T model and are shown on Figures 21 and 22 and described in the FS (NE&W, 2011d). Extraction and ex-situ treatment of groundwater would reduce the amount of contaminated groundwater movement to the north side of the East Gallatin River and mitigate risk to drinking water wells.

As mentioned with Alternative 5, pump and treat is a presumptive remedy for contaminated groundwater (EPA, 1996e) and no pilot test was necessary to determine its effectiveness. However, a pilot test would be necessary to optimize the effectiveness of this alternative.

9.1.13 Alternative 13 – Plume Remediation Pump and Treat (Off-site)

This alternative expands the system described in Alternative 12 by adding additional extraction pumping wells on the south side of the East Gallatin River (Figure 23). This alternative is designed to minimize the movement of PCE contaminated groundwater beyond the area presently served by City water and to remediate PCE contaminated groundwater in the central to northern portion of the groundwater plume. As described in Alternative 12, this alternative is a combination of groundwater extraction, ex situ treatment, and discharge or reinjection.

As mentioned with Alternatives 5 and 12, pump and treat is a presumptive remedy for contaminated groundwater (EPA, 1996e) and no pilot test was necessary to determine its effectiveness. However, a pilot test would be necessary to optimize the effectiveness of this alternative.

9.1.14 Alternative 14 – Monitored Natural Attenuation (MNA)

MNA refers to the reliance on natural processes to breakdown and attenuate contamination and thereby achieve site-specific remedial objectives within a time that is reasonable compared with the schedule offered by other, more active, methods (EPA, 1999a). Source control and long-term performance monitoring are key elements to MNA (EPA, 1999a and EPA, 2004a). Under favorable conditions, and in association with on-site source control or removal, natural attenuation processes act without additional human intervention to reduce mass, toxicity, mobility, volume, or concentrations of contaminants in soil or groundwater. These in situ processes include biodegradation, dispersion, dilution, sorption, and volatilization (EPA, 1999a). Chemical or biological stabilization, transformation, or destruction of contaminants are also important in situ processes of MNA (EPA, 2004a and ITRC, 2007b), but are expected to play a limited role at the BSS due to the aerobic aquifer. MNA is generally selected as a support technology or polishing tool, when or where active technology is not or no longer effective, and land use controls to prevent humans from being exposed to contaminated groundwater until cleanup levels are achieved are in place (EPA, 2004a). The success of MNA is evaluated through a long-term monitoring program.

9.2 SHARED AND DISTINGUISHING FEATURES

9.2.1 ERCLs

None of the alternatives are expected to meet all applicable or relevant federal and state ERCLs individually. However, various combinations of the alternatives will comply with all ERCLs. Appendix A contains the complete list of ERCLs identified for the BSS.

9.2.2 Long-Term Reliability of Remedy

With the exception of Alternative 1, all of the alternatives rely on institutional controls to help mitigate risk to human health at the BSS. Institutional controls are considered moderately reliable because they rely on human actions. All technology options being considered in the alternatives are considered reliable over the long term but each depends upon proper design, implementation, and maintenance.

9.2.3 Estimated Time for Design and Construction

All components within each alternative could be designed within one year or less and could be constructed within two years or less. The exception would be if additional injection points are needed for multiple applications for the enhanced bioremediation or the ISCO alternatives.

9.2.4 Estimated Time to Reach Cleanup Levels

Cleanup levels will not be met in the short-term or long-term for either groundwater or soil under any of the alternatives individually. However, in various combinations, it is possible to meet cleanup levels for both soil and groundwater in the long-term at the BSS. Please see Section 11.2, which is the discussion of the selected remedy, for specifics on timeframes for cleanup.

9.2.5 Cost

The cost estimate for each alternative is based on estimates of capital costs as well as operation and maintenance costs. Section 10.7 details the comparison of alternative costs. Table 16 details the estimated costs associated with each alternative, including the number of years of operation. A three percent discount rate is used in the cost estimates (Bugni, 2007).

9.2.6 Use of Presumptive Remedies

A presumptive remedy is a technology that EPA has determined, based upon its experience, generally will be the most appropriate remedy for a specified type of site. EPA establishes presumptive remedies to accelerate site-specific analysis of remedies by focusing feasibility study efforts (EPA, 1993a and 1993b). Although the BSS is not a CERCLA site, DEQ considered the presumptive remedy guidance during the alternatives analysis.

Soil vapor extraction is a presumptive remedy for volatile organics in soil (EPA, 1993b) and is a component of Alternatives 2, 4, and 7. Pump and treat is a presumptive remedy for contaminated groundwater and is a component of Alternatives 5, 12, and 13 (EPA, 1996e). Alternatives 1, 3, 6, 8, 9, 10, 11, and 14 do not include a presumptive remedy.

9.3 EXPECTED OUTCOMES

The residual source area at the BSC poses a current and future risk to human health and the environment by continuing to contaminate groundwater and soil vapor. Enhanced bioremediation of the saturated zone soil and groundwater in the residual source area will reduce contaminant concentrations of PCE in on-site groundwater and soil. It would also reduce PCE concentrations in soil vapor.

Ingestion and direct contact with contaminated groundwater pose current and future risks to human health. Groundwater use will be regulated through the continuation of the existing CGWA until groundwater is remediated to cleanup levels for the COCs. In addition, the City and CVS will provide an alternate municipal water supply to all residences and businesses south of the East Gallatin River whose drinking water wells have COC concentrations that exceed the

DEQ-7 standard, consistent with DEQ Water Quality Order WQ-93-101, and subsequent amendments. Once DEQ determines cleanup levels are met for groundwater, the CGWA and requirement to connect to alternate municipal water supply may be modified or removed.

Currently, inhalation of contaminated soil vapor is considered a risk to human health. SSCLs developed for soil vapors at the BSS are based on utility worker and construction worker scenarios. Therefore, for all alternatives, with the exception of Alternative 1, a trench and excavation construction permit system will require fresh air mechanical ventilation for construction trenches and excavations. This permit system will be required at Lots 1 and 2 of the BSC property and properties immediately north (with Beall Street as northern boundary) of the BSC (Figure 26). The use of fresh air ventilation in trenches will reduce COC concentrations to acceptable levels.

Inhalation of contaminated indoor air is considered a future risk to human health at the BSC. Due to the high levels of PCE vapors beneath the BSC building (subslab), indoor air concentrations may increase and exceed SSCLs if the building is remodeled, the HVAC system changes, or degradation of the subslab occurs. The SVE system will remove subslab vapors to minimize the chance that indoor air concentrations will increase. SSCLs developed for indoor air at the BSS, specifically the BSC, are based on a commercial worker scenario. Therefore, a restrictive covenant will be required on all of Lot 1 of the BSC and that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs (Figure 18) to limit the property use to commercial/industrial.

A restrictive covenant will also be required on the northwest corner of Lot 2 to prohibit the construction or development of structures that may interfere with the residual source area where active treatment (enhanced bioremediation) will occur. This restriction is limited to the time of active treatment; once the active treatment is complete, the restriction can be removed. As part of remedial design, the active treatment area will be surveyed and that surveyed area will be included in the restrictive covenant.

10.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

The alternatives are evaluated in the following section using seven cleanup criteria provided for in Section 75-10-721, MCA. These criteria are used to evaluate the different alternatives individually and against each other in order to select a remedy. The first two criteria, protectiveness and compliance with ERCLs, are threshold criteria that must be met in order for a remedy to be selected. The next five criteria are balancing criteria which must be evaluated in selecting the remedy. Table 16 provides the comparison of remedial alternatives for the BSS to these criteria. In addition to these criteria, DEQ considered the acceptability of the selected remedy to the affected community, as indicated by comments from community members and local government during the public comment period on the Proposed Plan. A list of the alternatives and their corresponding numbers is also provided to aid in this analysis.

- Alternative 1 - No Action
- Alternative 2 – In situ Enhanced Biodegradation
- Alternative 3 – In situ Chemical Oxidation
- Alternative 4 - Air Sparging
- Alternative 5 - Hydraulic Control/Containment
- Alternative 6 - Passive Soil Venting
- Alternative 7 - SVE
- Alternative 8 - New or Deeper Replacement Drinking Water Wells
- Alternative 9 - Point-of-Use Treatment Systems
- Alternative 10 - Connection to City Water
- Alternative 11 - Community Water System
- Alternative 12 - Plume Migration Control Pump and Treat
- Alternative 13 - Plume Remediation Pump and Treat
- Alternative 14 - Monitored Natural Attenuation

10.1 PROTECTIVENESS

The criterion requiring overall protection of public health, safety, and welfare and the environment addresses whether an alternative provides adequate short-term and long-term protection from unacceptable risks. Protection may be achieved by eliminating, reducing, or controlling exposure to unprotective levels of hazardous or deleterious substances present at the BSS. DEQ has determined that none of the alternatives used alone will provide adequate protection of public health, safety, and welfare and the environment in the short-term and long-term. Institutional controls and monitoring are necessary for short-term and long-term protectiveness no matter what alternatives are selected.

Alternative 1 is not expected to achieve groundwater cleanup levels in the off-site plume for approximately 27 years based on the F&T model (see Table 15).

Alternatives 2 through 5 focus on the on-site residual source remediation. When compared against each other, alternatives 2 and 3 provide comparable protectiveness. Alternatives 4 and 5 are less protective because they do not directly treat the residual source. Alternatives 4 and 5 provide better short-term protectiveness than Alternatives 2 and 3 because Alternatives 4 and 5 do not generate methane, vinyl chloride, sulfate, manganese, chromium, or arsenic in the groundwater or soil vapor.

Alternatives 6 and 7 focus on contaminated soil vapor, including on-site subslab soil vapor. Alternative 7 provides more protectiveness when compared to Alternative 6 because it mechanically extracts and treats the soil vapor.

Alternatives 8 through 11 focus on providing alternate drinking water. Alternatives 8 through 11 provide comparable protectiveness, as humans are not exposed to COCs exceeding DEQ-7 standards. None of the alternatives would provide protectiveness to the environment.

Alternatives 12 through 14 address the off-site dissolved groundwater plume. Over the long term, each alternative provides comparable protectiveness. Alternatives 12 and 13 provide more protectiveness in the short term when compared to Alternative 14 because they prevent contaminated water from moving to drinking water wells on the north side of the East Gallatin River.

10.2 COMPLIANCE WITH ERCLS

This criterion evaluates whether each alternative will meet applicable or relevant state and federal ERCLs identified for the BSS. DEQ has determined that none of the alternatives used alone will comply with ERCLs. However, these alternatives can be combined to achieve ERCLs.

Alternative 1 is not expected to attain ERCLs for approximately 27 years in the off-site groundwater plume. The on-site residual source would continue to contribute COCs to the dissolved groundwater plume causing exceedences of DEQ-7 standards and ERCLs are not met.

Alternatives 2 through 5 will all attain applicable ERCLs when combined with other alternatives. Alternatives 2 and 3 may generate treatment byproducts that cause temporary exceedences of ERCLs. However, Alternatives 2 and 3 are more likely to meet ERCLs in a shorter time period than Alternatives 4 and 5 because, overall, the technologies result in degrading or converting contaminants to innocuous compounds. The timeframe for Alternatives 4 and 5 to meet ERCLs is dependent upon the PCE absorbed to saturated soils and the presence of PCE ganglia.

Alternatives 6 and 7 will not achieve ERCLs on their own because they only address contaminated soil vapor.

Alternative 8 through 11 do not meet ERCLs by themselves, because these alternatives do not address the contamination in the dissolved groundwater plume, soil vapor, or the on-site residual source.

Alternatives 12 through 14 will meet ERCLs at some point in time. When combined with an alternative to address the on-site residual source, ERCLs would be met sooner. Alternatives 12 and 13 will meet ERCLs more quickly as they are more aggressive than Alternative 14.

10.3 MITIGATION OF RISK

This criterion evaluates mitigation of exposure to risks to public health, safety, and welfare and the environment to acceptable levels.

DEQ has determined that none of the alternatives used alone mitigate all risks to an acceptable level. Under the No Action Alternative 1, the on-site residual source material would remain and continue to contaminate groundwater and soil vapor. Unacceptable risk would continue to exist and not be mitigated.

None of the active alternatives mitigate all of the identified risks. Alternatives 2 through 5 directly address saturated soil and groundwater contamination from the on-site residual source, but do not directly address subslab soil vapor contamination. Alternatives 6 and 7 address soil vapor, including subslab soil vapor, but do not address saturated zone contamination. Alternatives 8 through 11 provide alternate drinking water to future impacted users. Alternatives 12 through 14 only mitigate risks associated with the dissolved groundwater plume. Therefore, a combination of some of these alternatives is needed to address the total risk at the BSS.

Alternative 2 will likely generate vinyl chloride and methane, which could increase risk in the short-term if not mitigated. Alternative 3 does not generate vinyl chloride or methane; however, metals and byproducts may be mobilized in the groundwater. Alternatives 2 and 3 have comparable long-term risk mitigation capacity to each other and better long-term risk mitigation when compared to Alternatives 4 and 5. Alternative 4 may increase COC concentrations in the soil vapor as COCs volatilize out of the groundwater, but these are captured and treated using an SVE system. Alternative 5 has better short-term risk mitigation capacity than Alternatives 2 through 4 because Alternative 5 is unlikely to generate contaminant byproducts during implementation. There may be health and safety risks to remediation workers because of uncontrolled chemical reactions or the corrosivity of the oxidant associated with Alternative 3. A site-specific health and safety work plan would be required as part of the remedial design that identifies the appropriate measures to take to protect workers when handling and applying an oxidant. The risks (vinyl chloride and methane generation) associated with Alternative 2 are controllable by adjusting substrate concentrations and injection rates or in combination with another alternative, such as an SVE system. The increased COC concentrations in soil vapor generated by Alternative 4 may be controlled by utilizing an SVE system. Alternatives 6 and 7 have better risk mitigation related to soil vapors than Alternatives 2, 3, 4, and 5 because Alternatives 6 and 7 directly address soil vapors, specifically subslab soil vapors. Alternative 7 has better risk mitigation than Alternative 6 because it treats soil vapors before releasing them to the atmosphere.

Alternatives 8, 10, and 11 have comparable levels of risk mitigation as each uses proven technologies to provide alternate drinking water. Alternative 9 has less risk mitigation because of the potential for coliform and bacteria to grow if the system is not properly maintained.

Alternatives 12, 13, and 14 focus on minimizing the movement of contaminated groundwater to the north side of the East Gallatin River and do not mitigate risks associated with potentially impacted drinking water unless combined with an alternate drinking water supply alternative. Alternative 13 has slightly better risk mitigation to the environment than Alternative 12 or 14 based on predicted cleanup timeframes when combined with other alternatives to address the on-site residual source. Alternative 12 has better risk mitigation than Alternative 14 because it actively pumps and treats the contaminated groundwater.

10.4 EFFECTIVENESS AND RELIABILITY

Each alternative is evaluated, in the short-term and the long-term, based on whether acceptable risk levels are maintained and further releases are prevented.

DEQ has determined that none of the alternatives alone are effective and reliable at addressing all of the COCs and contaminated media. Alternative 1 is not effective and reliable in the short-term and long-term because unacceptable levels of contamination would remain and contaminants would continue to be released from the on-site residual source. In the long-term, PCE would reach wells on the north side of the East Gallatin River and no alternate drinking water would be available to mitigate risk to human health.

The effectiveness of Alternative 2 was demonstrated by the bioremediation pilot test. However, incomplete dechlorination of COCs resulted in the generation of vinyl chloride. In addition, methane was generated as subsurface conditions were reduced. Vinyl chloride and methane can be controlled through remedial design. Alternative 2 will require paired injection wells with multiple injection internals to depths greater than 50 ft. Due to the depths, the Alternative 2 injection wells will be installed with auger or air rotary equipment. If additional injections are needed because of rebound issues, the Alternative 2 injections wells will still be in place. Alternative 3 utilizes commonly used technology, which should be effective for remediating the residual source. Alternative 3 may have issues associated with uncontrolled chemical reactions during chemical oxidant application. These issues can be controlled during remedial design and application procedures. Alternative 3 requires over 50 injection points to adequately apply the oxidant. However, the lithology at the BSC and limitations of direct push drilling equipment may limit the reliability of Alternative 3 with regard to installation of the injection points. Based on past drilling experience at the BSC, auger or air rotary equipment will not be impeded by the lithology. Alternative 4 has been demonstrated to be effective at addressing volatile contaminants at other sites. Alternative 4 can be incompatible with other technologies that create anaerobic conditions, such as Alternative 2, because it introduces oxygen into the groundwater. Alternative 5 can be effective for addressing the residual source and preventing the migration of COCs from the site.

Alternatives 2 through 5 are all reliable to a degree. The reliability of Alternatives 2 and 3 can be affected by the generation of vinyl chloride, methane, or other byproducts. The reliability of Alternative 4 can be affected by the increase of COC concentrations in the vadose zone. The reliability of Alternative 5 can be affected by the rate of decrease in contaminant concentrations slowing down over time; then followed by a rebound in contaminant concentrations (EPA, 1996d and EPA, 1997d). Alternatives 2 and 3 are expected to meet SSCLs sooner than Alternatives 4 and 5.

Alternative 7 has been demonstrated to be effective at addressing the COCs based on historic SVE operations at the BSC. Alternative 7 is more effective and reliable when compared to Alternative 6 because the amount of vacuum can be controlled mechanically where Alternative 6 relies on changes in the barometric pressure or groundwater levels. In addition, Alternative 7 is more effective because it treats the contaminated vapor before discharging to the atmosphere.

Alternatives 8 through 11 have comparable effectiveness and reliability in general, but Alternatives 9, 10, and 11 require comparatively more site management and operations and maintenance (O&M) than Alternative 8. O&M activities for Alternatives 9, 10, and 11 would be daily to monthly (EPA, 1985; PRC, 1994a; DEQ, 2005a; USBLS, 2010). Alternative 8 requires essentially the same management and O&M activities as existing drinking water wells, which is

less than Alternatives 9 and 11. Alternative 8 is effective and reliable because lithologic interpretation, proper well construction, and monitoring will ensure the new or deeper drinking water wells meet DEQ-7 standards.

Alternatives 12 through 14 have comparable effectiveness and reliability in addressing contamination in the off-site dissolved groundwater plume, but Alternatives 12 and 13 have extensive operational requirements. However, Alternatives 12 and 13 are predicted to attain DEQ-7 standards in a shorter time-period when compared to Alternative 14.

10.5 PRACTICABILITY AND IMPLEMENTABILITY

Under this criterion, alternatives are evaluated with respect to whether this technology and approach could be applied at the site.

All of the alternatives are practicable and most are administratively implementable. However, the alternatives that involve pumping and treating groundwater (Alternatives 5, 12, and 13) may have administrative difficulties related to groundwater appropriations and easement and property acquisition for system infrastructure (NE&W, 2011d). Alternative 10 (city water services to the area north of the East Gallatin River) may have administrative difficulties because the area would require annexation into the City to receive city water. The current City policy is not to extend City services beyond City limits and prefers annexations by petition (Bozeman, 2006). Alternative 11 (community water system north of the East Gallatin River) may have administrative difficulties because this alternative would require groundwater appropriations, easements, and property acquisition (NE&W, 2011d).

10.6 TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES

This criterion addresses use of treatment technologies or resource recovery technologies, if practicable, giving due consideration to engineering controls. These technologies are generally preferred to simple disposal options (see Section 75-10-721(2)(c)(iv), MCA).

Alternatives 1, 6, 8, 10, 11, and 14 do not include treatment or resource recovery technologies. The remaining alternatives all include some form of treatment or resource recovery technology. Alternative 2 uses enhanced bioremediation to treat contaminated soil and groundwater, and uses carbon adsorption to treat extracted contaminated vapors. Alternative 3 uses chemical oxidation to treat contaminated soils and groundwater. Alternative 4 extracts contaminated vapor from the subsurface soil and treats it using carbon adsorption. Alternatives 5, 12, and 13 extract contaminated groundwater and treat it using carbon adsorption. Alternative 7 extracts contaminated subslab soil vapor and treats it using carbon adsorption. Alternative 9 uses carbon adsorption with ultra-violet disinfection to treat groundwater prior to consumption.

10.7 COST EFFECTIVENESS

Under Section 75-10-721, MCA, cost-effectiveness is determined through an analysis of incremental costs and incremental risk reduction, and other benefits of alternatives considered,

taking into account the total anticipated short-term and long-term costs of remedial action alternatives considered, including the total anticipated cost of operation and maintenance activities.

Alternative 1 has the lowest cost, but no risk reduction. The other alternatives all reduce some risk, but need to be combined to result in an effective overall remedy that provides adequate risk reduction.

Alternatives 2 and 3 have comparable risk reduction (residual source) at comparable costs. Alternatives 4 and 5 have less risk reduction and slightly less cost when compared to Alternatives 2 and 3. Alternative 4 has slightly more cost than Alternative 5, but has less risk reduction than Alternative 5 because it could increase soil vapor concentrations.

Alternative 6 has higher cost, but less risk reduction when compared to Alternative 7.

Alternative 8 has lower cost than Alternative 9 which has lower cost than Alternative 11 which is lower than Alternative 10. All of these alternate water supply alternatives have comparable risk reduction.

Alternative 14 has lower cost than Alternative 12 which has lower cost than Alternative 13. Alternatives 12 through 14 have comparable long-term risk reduction. The difference is cleanup levels will be reached more quickly for Alternatives 12 and 13 than Alternative 14. Specifically, the groundwater modeling shows that the cleanup timeframe for Alternative 14 would be reduced by nine years utilizing a pump and treat system (Alternatives 12 or 13) (NE&W, 2011d). However, Alternatives 12 and 13 are estimated to cost between $6 and $7.2 million compared to $800,000 for Alternative 14. The principal risk associated with the dissolved plume is human exposure to COCs in drinking water. Therefore, when combined with an alternate water supply alternative, the dissolved plume alternatives provide comparable risk reduction during the short-term and Alternative 14 best attains the cost-effectiveness criterion.

The estimated present worth costs for the alternatives, not including the No Action alternative, range from approximately $329,000 for Alternative 8 to approximately $7.2 million for Alternative 13. Cost summaries for each alternative can be found on Table 16.

11.0 SELECTED REMEDY

11.1 SUMMARY OF THE RATIONALE FOR THE SELECTED REMEDY

DEQ's selected remedy for the BSS is a combination of alternatives set forth below.

- Enhanced bioremediation (Alternative 2): Enhanced bioremediation is the selected remedy for the on-site residual source, including saturated soils, intermittently saturated soils, PCE ganglia, and groundwater, and will reduce contaminant concentrations of PCE in groundwater. Enhanced bioremediation utilizes injection wells to deliver an organic

substrate to stimulate microbial growth and development, creating anaerobic conditions. A pilot test at the BSS demonstrated that enhanced bioremediation reduced PCE concentration in on-site shallow groundwater. Methane and vinyl chloride vapors were generated during the pilot test and treated with an SVE system. Vapor generated during enhanced bioremediation will be collected by an SVE system and treated prior to discharge to the atmosphere.

- SVE for on-site subslab soil vapors beneath the BSC building (Alternative 7): Removal of the subslab vapors will reduce the potential for these vapors to move upward and impact indoor air in the BSC building. This remedy will utilize an SVE system to remove the contaminated soil vapor from beneath the BSC building. Depending on the SVE system's ROI, soil vapor outside of the building footprint will also be reduced, including contaminated soil vapor along the former sewer line. The vapor will be treated prior to discharge to the atmosphere. If there is commercial/industrial development on that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs (Figure 18), the SVE system for on-site subslab soil vapors will be expanded, as necessary, to remove contaminated soil vapor from beneath the new building.

- New or deeper replacement drinking water wells (Alternative 8): The selected remedy to provide off-site alternate drinking water on the north side of the East Gallatin River where City water services are not available includes the installation of new or deeper drinking water wells for current and future users with wells impacted with PCE exceeding the DEQ-7 standard. The new or deeper replacement wells must be installed in accordance with the CGWA Order (DNRC, 1998). Water quality from the new or deeper water wells must meet DEQ-7 standards. As discussed in Section 9.1.8, groundwater F&T modeling predictions and local lithology indicate that contamination is unlikely to reach the depth of 180 ft bgs. However, if water quality from the new or deeper water wells does not meet DEQ-7 standards, the CGWA Order requires the installation of a water treatment unit. The current and future drinking water wells will be monitored to evaluate PCE concentration trend.

- MNA for off-site dissolved PCE plume (Alternative 14): The off-site dissolved plume concentration trends are established and on-site source treatment will occur. F&T groundwater modeling predicts the PCE concentrations in the dissolved groundwater plume will peak in about 5 to 10 years, depending upon each well's location relative to the leading edge of the plume, then begin to decline to below DEQ-7 standards. The selected remedy relies on on-site source treatment to reduce concentrations of dissolved PCE into the groundwater. In addition, remedies to prevent the public from being exposed to groundwater that has COC concentrations exceeding the standards will be in place.

- Institutional Controls: The selected remedy requires the City to implement institutional controls at the Facility in the form of a construction trench and excavation permit system that will require fresh air mechanical ventilation in construction trenches or excavations in the area shown on Figure 18. This permit system can be administered through one of the City's existing permits shown on Figure 26. The trench and excavation dimensions are described in Section 11.2.1.2. The permit system will be required to ensure protection of construction or utility workers until COC concentrations in soil vapors are below the SSCLs. In addition,

DEQ will require that land use at Lot 1 of the BSC and that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs be restricted to commercial/industrial use through use of a restrictive covenant in substantially the same form as the documents found in Appendix C. In addition, DEQ is requiring that no construction or development of structures occurs on the northwest corner of Lot 2 during the time that active treatment (enhanced bioremediation) is occurring, as construction or development in this area may interfere with the active treatment. As part of remedial design, the active treatment area will be surveyed and that surveyed area will be included in the restrictive covenant. This restriction is limited to the time of active treatment; once the active treatment is complete, the restriction can be removed. This restriction will occur through use of a restrictive covenant in substantially the same form as the document found in Appendix C. Finally, the existing CGWA Order will remain in place. This Order limits the installation of water wells, ensures that new wells will not induce or redirect contaminated groundwater, and ensures that no drinking water wells are installed within or adjacent to the BSS contamination where City water services exist. The CGWA is shown on Figure 1. Wells installed under the CGWA Order will be monitored in accordance with that Order and included in the long-term monitoring described below.

- City Water Connections (Alternative 10): The remedy integrates the requirements of DEQ Water Quality Order WQ-93-101, as amended, and requires the City and CVS to provide City water to the remaining residences and businesses south of the East Gallatin River who have not been connected to City water, if PCE concentrations in these wells meet or exceed 5 µg/L as identified by groundwater monitoring. This requirement also applies if PCE degradation products (TCE, DCE, and vinyl chloride) meet or exceed their respective MCL/DEQ-7 standards. Currently, 10 businesses/residences on the south side of the East Gallatin River use groundwater wells for drinking purposes. These wells are included in the long-term monitoring described below and the requirements for the provision of alternate water are described in Section 9.1.

- Long-Term Monitoring: Monitoring is necessary to evaluate the effectiveness of the remedy and to ensure that adjacent residential, commercial, and public water supply wells do not become contaminated. At a minimum, the City and CVS will monitor selected wells on a semi-annual basis for the first five years, and at a reduced frequency thereafter, until cleanup levels are achieved. DEQ will determine the required monitoring through a long-term monitoring program developed during and after remedial design.

Costs and assumptions used in calculating the total present value of the selected remedy are provided in Appendix B and Section 11.3. These are estimates only and are subject to change during remedial design and implementation. In compliance with CECRA requirements, and considering public comment received, DEQ has determined that the selected alternatives set forth herein comprise the appropriate remedy for the BSS.

The selected remedy will reduce risks to public health, safety, and welfare and the environment through the following:

- The selected remedy will meet both threshold criteria: overall protection of public health, safety, and welfare and the environment, and compliance with ERCLs. The remedy

accomplishes overall protection through in situ destruction and attenuation of contaminants in groundwater and soil, removal of contaminants in soil vapor, provision of alternate drinking water to people whose wells are contaminated with COCs greater than SSCLs, a construction trench and excavation permit system requiring fresh air mechanical ventilation, and implementation of institutional controls.

- The selected remedy mitigates risk to public health, safety, and welfare and the environment to an acceptable level because contaminated soils, soil vapor, and groundwater will be treated or attenuated, thereby reducing the potential for exposure or impact.

- The selected remedy provides short-term and long-term effectiveness and reliability because contaminated on-site soil and groundwater will be treated in situ through bioremediation, and contaminated soil vapors, including subslab soil vapors, will be removed and treated through carbon desorption prior to being discharged to the atmosphere. The on-site source treatment will help reduce the magnitude of the off-site contaminated groundwater plume. The trench and excavation permit system will reduce unacceptable risk to utility and construction workers by requiring fresh air mechanical ventilation for trenches and excavations that fall within defined dimensions.

- The selected remedy is technically practicable and readily implementable. The enhanced bioremediation and SVE have been effective at the BSC. The regional F&T groundwater model indicates that MNA will continue and decrease PCE concentrations in the off-site dissolved groundwater plume to concentrations less than SSCLs.

- The selected remedy uses treatment as a principal element of the remedy; it reduces the toxicity, mobility, or volume of hazardous or deleterious substances through treatment.

- The selected remedy is cost-effective and balances incremental costs and incremental risk reduction, focusing on in situ treatment combined with MNA for contaminated groundwater as opposed to ex-situ treatment, which is more expensive.

Based on the available data and using DEQ's expertise, DEQ finds that the selected remedy best meets the selection criteria and provides the appropriate balance considering site-specific conditions and criteria identified in CECRA.

11.2 DETAILED DESCRIPTION OF THE SELECTED REMEDY

DEQ selected a combination of alternatives to cleanup soil, soil vapor, including subslab soil vapor, and groundwater. These include enhanced bioremediation for treatment of the on-site residual source area, including residual soil contamination, soil vapor, and dissolved COC plume in groundwater; SVE for subslab soil vapors; new or deeper replacement drinking water wells (north side of river); and MNA for the off-site PCE dissolved groundwater plume; institutional controls; and long-term monitoring. The selected remedy is detailed below.

11.2.1 Site-Wide Elements

11.2.1.1 Long-Term Monitoring

The selected remedy includes monitoring site media during remedy construction and long-term operation and maintenance. This plan will be developed during remedial design, is subject to DEQ approval, and will include sampling and analysis to: confirm the satisfactory performance of the remedy; ensure protection of public health, safety, and welfare, and the environment during remedy implementation; verify attainment of cleanup levels; confirm achievement of RAOs; and verify compliance with ERCLs.

Monitoring will include sampling of some of the following: existing wells (currently 45 monitoring and drinking water wells) and additional wells that may be installed as part of remedial design or remedy, or installed under the CGWA Order. DEQ will determine the appropriate sampling locations during and after remedial design. At a minimum, the City and CVS will monitor selected wells on a semi-annual basis for the first five years and at a reduced frequency thereafter, until cleanup levels are achieved. Other analyses may be included to evaluate the effectiveness of the enhanced bioremediation or MNA. The monitoring frequency will then be re-evaluated and may be decreased to annually or another frequency that DEQ determines is appropriate, until cleanup is achieved. Water levels in monitoring wells will also be measured semi-annually during high and low groundwater elevations. Should detections of contaminants occur in residential or business wells at levels at or in excess of SSCLs, DEQ will require resampling of the well within 30 days. Should the initial detected concentration be verified, DEQ will require immediate connection of the residence or business to the City water supply, if available, or installation of a new or deeper replacement drinking water well.

Since irrigating lawns and food crops with contaminated groundwater at current concentrations does not present an unacceptable risk to human health or the environment, existing domestic wells could still be used for irrigation purposes after connection to city water (ATSDR, 1992).

11.2.1.2 Institutional Controls

The following institutional controls will be implemented or maintained:

- Groundwater Use Restrictions (CGWA): To protect human health and limit migration of contaminants through pumping, the selected remedy partially relies on institutional controls in the form of the existing CGWA Order to ensure that the installation of wells is limited, that new wells will not induce or redirect contaminated groundwater and that no drinking water wells are installed within or adjacent to the BSS contamination where city water services exist. While there are domestic and commercial/industrial use wells currently in operation in the vicinity of the BSS, the City supplies public water to the majority of homes and businesses in the area. Therefore, the impact of prohibition of additional wells is limited since an additional source of water is available.

- Land Use Restrictions (Restrictive Covenants): The selected remedy includes a requirement that the use of Lots 1 and that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs be restricted to commercial/industrial use through use of a restrictive covenant in substantially the same form as the documents found in Appendix C. Specifically, no residential development or use, including but not limited to permanent residential use; temporary residential use; limited residential use; short-term residential use; children's day care; mobile homes with or without footings; mobile home with or without a pad; or camping shall occur at these locations. In addition, the selected remedy includes a requirement that the construction or development of structures be prohibited on the northwest corner of Lot 2. As part of remedial design, the active treatment area will be surveyed and that surveyed area will be included in the restrictive covenant. The placement of restrictive covenants on these properties is provided for in Section 75-10-727, MCA. These restrictions will occur through use of a restrictive covenant in substantially the same form as the document found in Appendix C. Restrictive covenants for the BSC property will be in effect until DEQ determines they are no longer needed to ensure protection of human health.

- Construction Excavation/Trench Permit System: The selected remedy includes a permit system administered by the City that requires fresh air mechanical ventilation in construction trenches or excavations on Lot 1 and the northwest corner of Lot 2 of the BSC, the eastern edge of 1608 West Beall Street, 1602 West Beall Street, the southeast corner of 1605 West Beall Street, the southwest corner of 302 North 16th Avenue, and the City right-of-way associated with the intersection of West Beall Street and North 16th Avenue (see Figure 26). The City can require permit applicants to limit their open trench lengths, and most permitted trenches do not exceed 100 ft (ATC, 2011c and NE&W, 2011d). Therefore, a 100 foot long trench was the maximum length modeled (Trihydro, 2011). In the above-mentioned areas, trenches or excavations up to 100 ft long with the following dimensions (Trihydro, 2011) will require the fresh air mechanical ventilation (See Table 17):

    - less than 9 ft in width and greater than 10 ft in depth;
    - less than 6 ft in width and greater than 7 ft in depth; and
    - less than 3 ft in width and greater than 4 ft in depth.

  Trenches greater than 100 ft in length may require additional ventilation (Trihydro, 2011). If the City wishes to issue a permit for a trench longer than 100 ft in length, DEQ will require that the City and CVS evaluate and model the longer proposed trench to identity what size blower is necessary to provide adequate ventilation. Unless this additional evaluation and modeling is conducted, the City will require that permit applicants restrict their open trench length to 100 ft and will require an appropriately sized blower to provide fresh air in the trench or excavation.

11.2.2 Groundwater

11.2.2.1 Enhanced Bioremediation of the On-site Residual Source

Enhanced bioremediation utilizes injection wells to deliver the organic substrate to stimulate microbial growth and development creating anaerobic conditions. A pilot test was conducted using EOS® solution, an emulsified oil solution, as the substrate. The pilot demonstrated that the EOS® solution created an anaerobic or reduced environment and reduced PCE concentration in on-site shallow groundwater. The selected remedy of enhanced bioremediation for the on-site residual source will reduce contamination including PCE in saturated soils and intermittently saturated soils and PCE dissolved in groundwater to meet SSCLs.

The selected remedy expands the pilot test area. Optimization testing will be conducted as part of remedial design and during implementation to evaluate substrate concentration, injection rates and injection frequency. Figure 24 shows the conceptual design of the enhanced bioremediation system used for cost estimation purposes. The number and placement of injection wells may be modified during remedial design/optimization. Because the pilot test demonstrated that the EOS® solution is effective, EOS® solution will be used as the organic substrate. The EOS® solution will be injected into the groundwater throughout the on-site residual source area(s), including injections into the deeper portion (to a depth of 75 ft) of the aquifer to address contamination at depth.

Methane concentrations in the soil vapor exceeded 25% of the LEL during and two years following the pilot test. Methane concentrations were not observed outside of the treatment area during the pilot test. An SVE system was used to reduce the methane concentrations in the soil vapor. In addition, vinyl chloride was created and observed in soil vapor during the pilot test. Soil vapor probes will be installed throughout and downgradient (off-site) of the treatment area to evaluate methane and vinyl chloride concentrations. If methane concentrations or vinyl chloride concentrations in the soil vapor exceed 25% of the LEL or the SSCL, respectively, an SVE system will be utilized to remove and treat the vapors to ensure protection of receptors (i.e. indoor air in off-site structures).

During the pilot test, vinyl chloride in groundwater increased to concentrations exceeding the DEQ-7 standard downgradient of the treatment area. Specifically, vinyl chloride was detected in M-23, located approximately 150 ft downgradient of the pilot test, at 77 µg/L (ATC, 2010d) a year after the pilot test. However, vinyl chloride is easily broken down in aerobic conditions, and the vinyl chloride concentration in M-23 reduced to non-detect (less than 0.2 µg/L) in June 2011 (ATC, 2011e). Monitoring wells downgradient (off-site) of the treatment area will be installed and/or sampled to evaluate vinyl chloride concentrations. The closest drinking water well to the treatment area is over two miles away. The naturally aerobic groundwater conditions are expected to attenuate the vinyl chloride concentrations to less than the MCL (2 µg/L) before it reaches drinking water wells. This is supported by the absence of vinyl chloride in M-23 in June 2011. During remedial design, injection rates and substrate concentrations will be evaluated to minimize the vinyl chloride generation in off-site groundwater. If performance monitoring indicates that vinyl chloride is not oxidizing at a rate that will prevent receptors (i.e., drinking water wells) from being exposed to unacceptable levels of contamination, DEQ will

require additional remedial measures, such as use of an air sparging system, to protect human health.

The conceptually designed enhanced bioremediation system includes a single application of EOS® solution (Figure 24). If COC rebound is observed, additional EOS® solution application(s) will be conducted. Regular sampling will measure the effectiveness of the system. SSCLs are expected to be achieved in approximately five years.

11.2.2.2 MNA for the Off-site Dissolved Plume

Concentrations of PCE in downgradient off-site groundwater exceed the DEQ-7 standard. Historic groundwater monitoring shows that COC concentrations have decreased over time as a result of interim actions at the BSC (e.g., septic system removal, SVE, etc.) (NE&W, 1999b and ATC, 2011b). To date, all wells impacted above the DEQ-7 standard have been replaced with City water services. The selected remedy includes a provision for providing alternate drinking water to users (connection to city water of new or deeper replacement wells) whose wells are impacted with PCE concentrations exceeding the DEQ-7 standard. In addition, the CGWA limits the installation of drinking water wells within the dissolved groundwater plume. Based on soil vapor sample concentrations, COCs in soil vapor do not exceed SSCLs, except for on-site and the area immediately downgradient of the BSC.

The selected remedy of MNA for the off-site dissolved plume is appropriate because the off-site dissolved plume concentration trends are established and on-site source removal will occur. Groundwater modeling predicts the PCE concentrations in the dissolved groundwater plume will peak in about 5 to 10 years, depending upon each well's location relative to the leading edge of the plume, then begin to decline to below DEQ-7 standards. Groundwater modeling shows that dissolved PCE will exceed the DEQ-7 standard in the off-site groundwater for approximately 25 years after on-site residual source removal. Remedies to prevent the public from being exposed to groundwater that has PCE concentrations exceeding the DEQ-7 standard will be in place. Current and future impacted wells will be replaced by new or deeper wells or replaced by City water services, where available. Regular sampling as part of the long-term groundwater monitoring program will track the decline in the PCE concentrations in groundwater at the BSS.

11.2.3 Subslab Soil Vapor

An SVE system will reduce contaminant concentrations in the subslab soil vapor beneath the BSC building. Depending on the SVE's ROI, soil vapor outside of the building footprint will also be reduced, including contaminated soil vapor along the former sewer line. SVE has been used on-site in the past and reduced contaminant concentrations in the soil that were contributing to the groundwater and soil vapor contamination.

The selected remedy will ensure that subslab soil vapors throughout the BSC building footprint are addressed and will minimize potential impacts to indoor air through vapor intrusion. Depending on the SVE system's ROI, soil vapor outside of the building footprint will also be reduced, including contaminated soil vapor along the former sewer line. Additional information on soil vapor concentrations along the former sewer line is necessary before a determination can be

made of whether soil vapors in this area exceed the SSCLs. Therefore, sampling of the soil vapor along the former sewer line behind the BSC building for COCs is included as part of the remedy, on a schedule to be determined during remedial design. Based upon the results of the sampling, DEQ will determine what actions are necessary, such as expansion of the SVE system.

Optimization testing will be conducted during remedial design and implementation to evaluate SVE extraction point/well placement (e.g., number, spacing), vacuum, and extraction frequency. Figure 25 shows the conceptual design of the SVE system at the BSC building. Actual design of the system will occur as part of remedial design and based on soil vapor probe monitoring results. Vapors extracted by the SVE system will be treated through carbon absorption prior to discharging to the atmosphere.

As discussed in Section 9.1.7, prior application of SVE at the BSC showed an SVE ROI ranging from 40 to over 100 ft based on vacuum exceeding 0.1 inches of water in measured points. However, if the appropriate ROI cannot be achieved, additional SVE points/wells may have to be installed, including SVE points/wells inside the building. Remedial design and optimization testing may demonstrate the need for a more powerful SVE blower, different operational frequencies, and/or a different number of extraction points.

Regular sampling will be conducted to track the decline in the PCE concentrations in soil vapor at the BSC, and used to adjust vacuum, and evaluate SVE point/well placement. The sampling schedule will be developed during remedial design. Indoor air sampling may also be conducted to demonstrate that indoor air PCE concentrations are decreasing in response to decreasing subslab soil vapor concentrations.

If there is commercial/industrial development on that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs (Figure 18), the SVE system for on-site subslab soil vapors will be expanded, as necessary, to remove contaminated soil vapor from beneath the new building.

<u>Determination That Subslab Soil Vapor Cleanup Criteria Has Been Met</u>

DEQ did not calculate SSCLs for subslab soil vapor due to the variability in contaminant concentrations observed in the subslab soil vapor samples and the inherent extreme variability in the factors at the BSS that can result in the vapor intrusion pathway being complete (DEQ, 2011b).

Operation of the SVE system will require continuous optimization to ensure maximum contaminant recovery. The total mass (as evidenced by concentrations measured in the SVE effluent) typically decreases rather quickly within several weeks to a few months of operation and then reaches a condition where total concentration and mass removal rates have stabilized; this generally occurs when the extracted vapor concentrations do not vary by more than 1 to 5 percent during several consecutive monitoring events (DTSC, 2010). When stabilized conditions are observed, optimization activities, including but not limited to adjusting the SVE system air flow in wells, will be conducted. Once the SVE system has been optimized to the extent feasible, a sufficient period of time has passed since system shutdown to allow residual COCs to equilibrate to steady-state conditions, and a rebound assessment indicates that RAOs have been achieved, a system shutdown can be proposed. Indoor air and subslab soil vapor samples will be

collected from the BSC building as part of the performance monitoring. System construction, optimization, sampling, and system shutdown criteria will be developed during remedial design.

11.2.4 Off-site Alternate Drinking Water (New or Deeper Replacement Drinking Water Wells)

As described in Section 11.2.1.1, current and future drinking water wells will be included in the long-term monitoring portion of the remedy. If PCE concentrations in an existing well or a new well located north of the East Gallatin River, where City water services are not currently available, exceed the DEQ-7 standard, a new or deeper replacement water well will be installed. This area is within the existing CGWA described in Section 6.2.1 and the installation of wells within this area must comply with the CGWA Order (DNRC, 1998). New or deeper drinking water wells installed under this portion of the remedy will be installed in uncontaminated portions (deeper than 180 ft) of the aquifer. The new or replacement well must be sampled in accordance with the CGWA Order, which also requires the well owner to provide a dedicated space to accommodate installation of a water treatment system, if groundwater conditions change in the future.

As discussed in Section 9.1.8, groundwater modeling predictions and local lithology indicate that contamination is unlikely to reach the depth of 180 ft bgs. As a precautionary measure, the new or deeper drinking water wells will be installed with special grouting and sealing to minimize any potential for vertical contaminant migration. New or replacement wells will be included in the long-term monitoring program to evaluate PCE concentration trends. To ensure that the water quality from the new or deeper water wells meets DEQ-7 standards, DEQ may require the new or replacement wells to also be sampled for other water quality parameters, such as iron and manganese. If water quality from the new or deeper water wells does not meet DEQ-7 standards, the CGWA Order requires the installation of a water treatment unit.

11.2.5 RAOs and Performance Standards

DEQ has established its RAOs for each contaminated media in Section 8.0.

SSCLs for groundwater, subsurface soil, and soil vapor are provided in Tables 1, 2, and 3, respectively. Section 7.0 details the development of SSCLs for the BSS.

11.3 COST ESTIMATE FOR THE SELECTED REMEDY

Table 18 summarizes capital and operation and maintenance costs and the present value analysis for the selected remedy. Appendix B presents detailed summaries of the costs and assumptions for each component of the selected remedy.

The total present worth value of the selected remedy is approximately $5,876,249 (Table 18). These cost estimates were based on the information presented in the FS (NE&W, 2011d). Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. This is a feasibility-level engineering cost estimate expected to be within plus fifty to minus thirty percent of the actual project cost.

11.3.1 Cost Uncertainties

Remedial design will play a critical role in determining final costs for the BSS remedy and will be more reflective of actual costs than the estimated costs presented in this ROD. Optimization testing during remedial design and implementation will provide the information necessary to refine cost estimates. Uncertainties that may affect the costs of the selected remedy include but are not limited to:

- The time required for monitoring may increase or decrease the costs of the monitoring.

- Increases or decreases in the number of wells to be monitored as part of long-term groundwater monitoring may increase or decrease the costs of monitoring.

- Costs associated with sampling to determine if the COCs in the soil vapor along the former sewer line exceed the SSCLs were not included in the cost estimates. If COCs exceed the SSCLs, the subslab SVE system may have to be modified or expanded, which may increase costs. If commercial/industrial development occurs on the portion of Lot 2 of the BSC that exceeds SSCLs and expansion of the SVE system is necessary, costs may be increased.

- Cleanup levels may change if DEQ recalculates potential cancer risks and non-cancer effects or SSCLs for COCs based on updated toxicity information.

- Costs associated with confirmation sampling were not included in the cost estimates. Costs associated with these samples may increase the cost of the selected remedy.

- Costs associated with agency oversight of the remedial actions were not included in the cost estimates for the selected remedy. Costs associated with agency oversight may increase the cost of the selected remedy.

11.4 ESTIMATED OUTCOMES OF SELECTED REMEDY

The selected remedy uses a combination of institutional controls; soil, soil vapor, and groundwater treatments; and alternate drinking water to control exposures and protect public health, safety, and welfare and the environment over the long term. The remedy will reduce contaminant concentrations through a combination of technologies that cleanup soil vapor beneath the BSC building, cleanup soils and groundwater in the residual source area, and accelerate cleanup of the contaminated groundwater. The technologies selected by DEQ include a combination of in situ enhanced bioremediation, extraction and ex-situ treatment. Successful treatment of contaminated soil in the residual source area will reduce the continuing source of contamination contributing to groundwater and soil vapor concentrations. After completion of enhanced bioremediation, soil contaminant concentrations will be below levels of concern for protection of groundwater. Groundwater concentrations are expected to be at or below cleanup levels. Institutional controls, along with monitoring and maintenance, will prevent or mitigate exposure risks to on-site workers or visitors during remedy implementation, will ensure people

are not drinking water that exceeds groundwater standards, and will ensure residential use does not occur on limited areas of the BSC where SSCLs are not protective of that use.

It will likely take one year for remedial design and two years for construction, not including provision of alternate water. After designs are complete, current estimates indicate that the on-site residual source enhanced bioremediation will take approximately five years to achieve SSCLs depending on the number of applications needed. The subslab soil vapor extraction is estimated to operate for approximately 10 years. The connection to City water or the installation of new or deeper replacement drinking water wells will be conducted on an as needed basis, and will be completed within a month after the need is identified for each location. Long-term monitoring, including MNA monitoring, will continue until groundwater concentrations are below cleanup levels and all other SSCLs are met.

Land uses are not expected to change as a consequence of the remedial action. Land use is expected to remain commercial/industrial at the BSC. Institutional controls in the form of restrictive covenants will ensure that Lot 1 of the BSC and that portion of Lot 2 of the BSC containing soil vapor exceeding SSCLs is restricted to commercial/industrial uses. In addition, institutional controls will prohibit the construction or development of structures on the northwest corner of Lot 2 of the BSC during the time active treatment (enhanced bioremediation) is occurring.

Groundwater use will continue to be restricted by the CGWA described in this ROD, and these restrictions will remain in effect until groundwater cleanup levels are achieved. Groundwater use restrictions are necessary to prevent use of contaminated groundwater and to minimize migration of contaminated groundwater that could occur by pumping adjacent or nearby groundwater. After groundwater cleanup levels are achieved, groundwater will again be available for unrestricted use and as allowed by local regulations and the CGWA. The timeframe for achieving groundwater cleanup levels throughout the plume, following on-site source control, is expected to be met within 25 years. Portions of BSS contaminated groundwater may meet cleanup levels sooner than source areas. Unrestricted use of groundwater outside source areas may be allowed prior to complete cleanup of the source areas if these uses would not cause adverse effects as described in the CGWA.

Contamination associated with the BSS was not found to pose an unacceptable risk to ecological receptors, but the treatment and attenuation of contaminants in groundwater and soils is expected to produce a positive effect for those receptors.

Currently, inhalation of soil vapor by utility/construction workers poses the most immediate potential risk. Therefore, DEQ anticipates that this portion of the remedy (i.e., the construction trench/excavation permit system) will be implemented during the remedial design of the other elements of the selected remedy.

12.0 STATUTORY DETERMINATIONS

Under Section 75-10-721, MCA, of CECRA, DEQ must select a remedy that will attain a degree of cleanup of the hazardous and deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment. In approving or carrying out remedial actions performed under Section 75-10-721, MCA, DEQ must require cleanup consistent with applicable state and federal ERCLs, and may consider substantive state and federal ERCLs that are relevant to site conditions. In addition, DEQ must select a remedy considering present and reasonably anticipated future uses, giving due consideration to institutional controls. The selected remedy must mitigate risk, be effective and reliable in the short- and long-term, be practicable and implementable, and use treatment or resource recovery technologies, if practicable, giving due consideration to engineering controls. The selected remedy must also be cost effective.

The selected remedy is protective of public health, safety, and welfare and the environment, complies with ERCLs, mitigates risk, is effective in the short- and long-term, is practicable and implementable, uses treatment and resource recovery technologies, and is cost-effective.

The following sections discuss how the selected remedy meets the CECRA statutory requirements.

12.1 PROTECTION OF PUBLIC HEALTH, SAFETY, AND WELFARE AND THE ENVIRONMENT

CECRA provides that protection of public health, safety, and welfare and the environment is a threshold criterion in selecting a remedy. DEQ has determined that the selected remedy appropriately protects public health, safety, welfare and the environment through the following:

- In situ enhanced bioremediation for the on-site residual source, including saturated soils, intermittently saturated soils, PCE ganglia, and groundwater, will reduce contaminant concentrations of PCE in groundwater. In addition, COC soil vapor concentrations will be reduced when the SVE system extracts contaminated vapors that result from the bioremediation.

- The SVE will reduce COC concentrations in the soil vapor, specifically the subslab soil vapor, and protect future on-site workers/visitors from the inhalation of contaminated indoor air as a result of vapor intrusion. Depending on the SVE ROI, the subslab SVE system will also reduce soil vapor concentrations along the former sewer line, which will protect future on-site utility/construction workers from the inhalation of contaminated soil vapors.

- New or deeper replacement drinking water wells and the connection to City water will protect residents or businesses from the ingestion of contaminated groundwater.

- MNA, in combination with on-site source remediation and the provisions to provide alternate drinking water, will be protective of human health and the environment.

- The construction excavation and trench permit system will require fresh air mechanical ventilation to protect utility and construction workers from the inhalation of contaminated soil vapors.

- Placement of restrictive covenants on Lot 1 of the BSC property and that portion of Lot 2 of the BSC property that exceeds SSCLs will restrict the property to commercial/industrial use which is contemplated by the indoor air SSCL.

- Placement of restrictive covenants on the northwest corner of Lot 2 of BSC property will prohibit the construction or development of structures on that area and prevent interference with the implementation of the enhanced bioremediation remedy for the on-site residual source area. This restriction on Lot 2 is limited to the time of active treatment; once the active treatment is complete, the restriction can be removed.

- Continuation of the CGWA, in combination with long-term monitoring of existing and future drinking water (residential and business) and monitoring wells, will protect the public from ingestion of groundwater, and prevent the migration of contamination through pumping.

- Implementation of the final remedy will ensure protection of the limited ecological receptors at the BSS.

12.2 COMPLIANCE WITH ERCLS

Remedial actions undertaken pursuant to CECRA must "attain a degree of cleanup of the hazardous or deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment." Section 75-10-721(1), MCA. Additionally, Sections 75-10-721(2)(a) and (b), MCA, provide that DEQ must require cleanup consistent with applicable state or federal ERCLs. The statute also provides for DEQ consideration of substantive ERCLs that are relevant to the site conditions. In order to assist DEQ in ensuring that the required cleanup is consistent with ERCLs, DEQ identifies those laws or regulations that have been promulgated which are applicable or relevant to the facility. The identification of ERCLs is listed in Appendix A of this ROD. The selected remedy will comply with all applicable and relevant ERCLs in approximately 25 years.

12.3 MITIGATION OF RISK

The selected remedy for the on-site residual source was selected over other alternatives because it is expected to achieve substantial and long-term risk reduction through in situ treatment. Enhanced bioremediation of the residual source area will directly address saturated soil and groundwater contamination. An SVE system will remove and treat contaminated vapors generated during the enhanced bioremediation. The SVE system for the subslab soil vapor removes soil vapor contamination from beneath the BSC building and treats vapors before releasing them to the atmosphere. Depending on the SVE ROI, the subslab SVE system will also reduce soil vapor concentrations along the former sewer line. New or deeper replacement

drinking water wells will provide alternate water and minimize risk to groundwater users. MNA will minimize the movement of contaminated groundwater as COC concentrations decrease to below standards. The existing CGWA will minimize human exposure to contaminated drinking water. Institutional controls at the BSC and adjacent properties, such as a permit requiring fresh air mechanical ventilation in certain trench/excavation sizes and limits on residential use, will prevent unacceptable risks to indoor air and soil vapor.

12.4 EFFECTIVENESS AND RELIABILITY

The selected remedy is effective in that it reduces the risk and allows the BSS to be used for the reasonably anticipated future land use, which includes commercial, light industrial, residential, and agricultural. The existing CGWA will minimize human exposure to contaminated drinking water. Institutional controls at the BSC and adjacent properties, such as a trench/excavation permit and limits on residential use, will prevent unacceptable risks to indoor air and soil vapor. Long-term and performance monitoring, and operation and maintenance also provides for the long-term effectiveness and reliability of the remedy.

12.5 PRACTICABILITY AND IMPLEMENTABILITY

The selected remedy is technically practicable and implementable at the BSS because all of the technologies are routinely used successfully in the environmental field and the materials necessary are widely available. The enhanced bioremediation injections can be performed in the limited available area without impeding long-term use of the commercial parking lot.

12.6 USE OF TREATMENT OR RESOURCE RECOVERY TECHNOLOGIES

The selected remedy is expected to achieve substantial risk reduction through treatment of contaminants in groundwater, soil, and soil vapor.

12.7 COST EFFECTIVENESS

The selected remedy is cost-effective, taking into account the total short- and long-term costs of the actions, including O&M activities for the entire period during which the activities will be required. The selected remedy provides overall risk reduction proportionate to the costs. To the extent that the estimated cost of the selected remedy exceeds the costs of the other alternatives, the difference in cost is reasonably related to the greater overall reduction in risk provided by the selected remedy and the reliability. The detailed evaluation of the balance of these criteria among the alternatives considered is set forth in the FS and in Section 10, Comparative Analysis of Alternatives, of this ROD.

13.0 DOCUMENTATION OF NOTABLE CHANGES FROM PREFERRED ALTERNATIVE OF PROPOSED PLAN

The Proposed Plan for the BSS was released for public comment on February 28, 2011. The Proposed Plan identified a combination of Alternative 2 (enhanced bioremediation) to address the on-site residual source; Alternative 7 (SVE) to address soil vapors, including on-site subslab; Alternative 8 (new or deeper replacement drinking water wells) to provide alternate drinking water on the north side of the East Gallatin River; and Alternative 14 (MNA) to reduce COC concentrations in the off-site dissolved groundwater plume. The preferred remedy also included institutional controls and long-term monitoring. DEQ has reviewed and responded to all written and oral comments for the Proposed Plan submitted during the public comment period (See Section 3). DEQ made the following specific changes to the selected remedy set forth in the Proposed Plan.

Off-site Vinyl Chloride in Groundwater: During the selected remedy of enhanced bioremediation, vinyl chloride will likely be generated and increases in concentrations exceeding the DEQ-7 standard (0.2 µg/L) downgradient of the treatment area are likely to be observed. The ROD includes the installation and/or monitoring of wells downgradient (off-site) of the treatment area to evaluate vinyl chloride concentrations. In response to public comment, the ROD also requires that injection rates and substrate concentrations be evaluated during remedial design to minimize the vinyl chloride generation in off-site groundwater. If performance monitoring indicates that vinyl chloride is not oxidizing at a rate that will prevent receptors (i.e., drinking water wells) from being exposed to unacceptable levels of contamination, DEQ will require additional remedial measures, such as air sparging, to protect human health. The FS identified air sparging as a remedy that is effective on chlorinated solvents and meets CECRA criteria. Air sparging was not selected as the primary remedy, but can be used as a polishing tool to address vinyl chloride concentrations in groundwater downgradient of the enhanced bioremediation treatment area if receptors are threatened. Costs associated with air sparging to address vinyl chloride in groundwater downgradient of the enhanced bioremediation treatment were not included in the cost estimates. However, the FS described air sparging (Alternative 4), and provided costs (NE&W, 2011d).

Estimated Extent of Contaminated Soil Vapor: The area of soil vapor contamination that exceeds the SSCLs is shown on Figure 18 and is approximately 148,994 sq ft. This area is expanded from the area shown in the Proposed Plan (DEQ, 2011b) to include the area where PCE was detected in November 1996 at sample VS-14 (9,000 $\mu g/m^3$) (NE&W, 1999b and DEQ, 2011s). The area shown on Figure 18 includes the former sewer line behind the BSC building to the former dry cleaner service line. The ROD includes soil vapor sampling along the former sewer area to determine if COCs in soil vapor exceed the SSCLs. This sampling will occur as part of remedial design. Based upon the results of the sampling, DEQ will determine if the SVE system needs to address that area. This revision may increase costs associated with the SVE system.

Institutional Controls: In response to public comments about the scope of institutional controls required on the BSC property, DEQ has clarified and narrowed, to the maximum extent possible, the properties at the BSC subject to these controls.

14.0 ADMINISTRATIVE RECORD REFERENCES

DEQ cited, relied upon, or considered the following documents in selecting the remedy for the BSS. It does not include legal citations such as those found in the MCA, ARM, United States Code, and Code of Federal Regulations (CFR). Any document, model, or other reference identified in the Final RI report (NE&W, 1999b), final BHHRA report and addendums (DEQ, 2010c, 2010d, and 2011a), and the final FS report (NE&W, 2011d) are also incorporated herein as part of the administrative record.

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FIGURES

TABLES

Table 1
Groundwater Cleanup Levels
Bozeman Solvent Site

Contaminant of Concern	DEQ-7 Standard (ug/L)
Tetrachloroethene (PCE)	5
Trichloroethene (TCE)	5
cis-1,2-Dichloroethene (cis-1,2-DCE)	70
Vinyl Chloride	0.2

ug/L - microgram per liter (parts per billion)
DEQ-7: DEQ, 2010

Table 2
Subsurface Soil Cleanup Levels
Bozeman Solvent Site

Contaminant of Concern	Cleanup Level (mg/kg)
PCE	0.19
TCE	0.087
cis-1,2-DCE	0.57

mg/kg - milligrams per kilogram (parts per million)
The cleanup levels shown are based on leaching to groundwater only. Direct contact risks were not unacceptable or will be protected with these levels.

Table 3
Soil Vapor Cleanup Levels
Bozeman Solvent Site

Contaminant of Concern	On-Site Utility Worker Cleanup Level (µg/m3)	On-Site Construction Worker Cleanup Level (µg/m3)	Off-Site Construction Worker Cleanup Level (µg/m3)
PCE	7,000	340	1,100
TCE	16,000	990	NA
Vinyl Chloride	16,000	450	NA
methane	12,500 ppm		

The methane SSCL is based on 25% of the LEL (5% by volume of or 50,000 parts per million [ppm]).
µg/m3 - micrograms per cubic meter
NA - not appliccable

Table 4
On-site Subslab Soil Vapor Cleanup Criteria
Bozeman Solvent Site

The SVE system will operate as long as significant PCE mass continues to be removed. Specifically, the SVE system will operate until sub-slab soil vapors are reduced to concentrations that are not expected to pose a risk to indoor air, and there is no rebound effect (increase of contaminant concentrations) observed after the SVE system is shut down for a prolonged period. Rebound effect would be determined based on soil vapor and/or sub-slab vapor samples collected from the BSC.

Table 5
Indoor Air Cleanup Levels
Bozeman Solvent Site

Contaminant of Concern	Commercial Cleanup Level (µg/m3)	Residential Cleanup Level (µg/m3)
PCE	22.3	4.4

µg/m3 - micrograms per cubic meter

Table 6
Occurrence of Contaminants of Concern Detected in Groundwater
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	Groundwater
Exposure Medium:	Groundwater

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.23 J	4,780	ug/L	1074/1670
Trichloroethene	0.376	146	ug/L	257/1637
cis-1,2-Dichloroethene	0.52	519	ug/L	231/1627
Vinyl Chloride	0.18	707	ug/L	23/1627

Notes: J - estimated value

Table 7
Occurrence of Contaminants of Concern Detected in Subsurface Soil
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	Subsurface Soil
Exposure Medium:	Subsurface Soil

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.062 J	20,000	mg/kg	48/98
Trichloroethene	0.1 BD J	110	mg/kg	15/97
cis-1,2-Dichloroethene	0.043 J	150	mg/kg	16/77

Notes: J - estimated value
BD - below detection limit

Table 8
Occurrence of Contaminants of Concern Detected in Surface Water
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	Surface Water
Exposure Medium:	Surface Water

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.98	20	ug/L	29/42

Table 9
Occurrence of Contaminants of Concern Detected in Soil Vapor
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	Soil Vapor
Exposure Medium:	Soil Vapor (on-site and off-site)

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	2.4	9,000	ug/m3	51/52
Trichloroethene	0.25	110	ug/m3	33/52
cis-1,2-Dichloroethene	0.76 J	0.76 J	ug/m3	Jan-52

Notes: J - estimated value
Includes June 2009 and November 1996 data; The 1996 data was converted from ug/L to ug/m3 (DEQ, 2011s).
The soil vapor data from the Enhanced Bioremedation Pilot Test is not included in this table.

Table 10
Occurrence of Contaminants of Concern Detected in On-site Indoor Air
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	On-site Indoor Air
Exposure Medium:	On-site Indoor Air

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.31	11	ug/m3	11/11

Table 11
Occurrence of Contaminants of Concern Detected in Off-site Indoor Air
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	Off-site Indoor Air
Exposure Medium:	Off-site Indoor Air

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.25	360	ug/m3	93/124

Includes Crawl Space Samples

Table 12
Occurrence of Contaminants of Concern Detected in On-site Subslab Soil Vapor
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	On-site Sub-Slab Soil Vapor
Exposure Medium:	On-site Indoor Air

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.12	32,000	ug/m3	48/48

Table 13
Occurrence of Contaminants of Concern Detected in Off-site Subslab Soil Vapor
Bozeman Solvent Site

Scenario Timeframe:	Current
Medium:	Off-site Sub-Slab Soil Vapor
Exposure Medium:	Off-site Indoor Air

Chemical of Concern	Concentration Detected		Units	Frequency of Dectection
	Minimum	Maximum		
Tetrachloroethene	0.47	360	ug/m3	27/28

Table 14
Summary of Cancer Risk and Non-cancer Hazard Estimates
Bozeman Solvent Site

Receptor Group	Pathways	Cancer Risk	Non-cancer Hazard Index
On-Site Utility Worker	Incidental Ingestion – soil	7.00E-06	9.00E-02
	Dermal Contact – soil	2.00E-07	2.00E-03
	Incidental Ingestion – groundwater	3.00E-08	4.00E-04
	Dermal Contact – groundwater	3.00E-07	4.00E-03
	Inhalation – subsurface soil vapor	**6.00E-05**	**5.00E+00**
	TOTALS	**6.00E-05**	**5.00E+00**
On-Site Construction Worker	Incidental Ingestion – groundwater	2.00E-07	3.00E-03
	Dermal Contact – groundwater	2.00E-06	3.00E-02
	Inhalation – subsurface soil vapor	**3.00E-04**	**3.00E+01**
	TOTALS	**4.00E-04**	**3.00E+01**
Off-Site Construction Worker	Incidental Ingestion – groundwater	5.00E-08	7.00E-04
	Dermal Contact – groundwater	8.00E-07	1.00E-02
	Inhalation – subsurface soil vapor	**3.00E-04**	**1.00E+01**
	TOTALS	**3.00E-04**	**1.00E+01**
Off-Site Agricultural Worker	Incidental Ingestion – groundwater	2.00E-07	3.00E-03
	Dermal Contact – groundwater	3.00E-06	5.00E-02
	TOTALS	4.00E-06	5.00E-02

Notes:

1) Cancer risk and non-cancer hazard index estimates are based on the reasonable maximum exposure concentration.

2) **BOLD**, indicates that the cancer risk exceeds 1 x 10^{-5} or the non-cancer hazard index exceeds 1.0.

Table 15
Fate and Transport Model Cleanup Predictions
Bozeman Solvent Site

Model Scenario	Applicable Alternatives	Projected Time to Attain SSCLs (years)	
		Entire Plume	North of East Gallatin River
1	No Action MNA without Source Control/Remediation	27	20
2	MNA with Source Control/Remediation	25	20
3	Plume Migration Pump and Treat without Source Control/Remediation - Alignment A	24	11
	Plume Migration Pump and Treat without Source Control/Remediation - Alignment B	16	12
4	Plume Migration Pump and Treat with Source Control/Remediation - Alignment A	22	11
	Plume Migration Pump and Treat with Source Control/Remediation - Alignment B	16	12
5	Plume Remediation Pump and Treat without Source Control/Remediation	16	7
6	Plume Remediation Pump and Treat with Source Control/Remediation	16	7

From: Final Feasibility Study (Nicklin Earth & Water, 2011d)

Notes:

1) "without source control" indicates no remediation implemented a Zone 5 (on-site) residual source. However, the source continues to attenuate.
2) "source control" indicates effective remediation of the Zone 5 (on-site) residual source.
3) The regional Fate and Transport (F&T) model only applies to the off-site groundwater plume because the resolution of the model cells is too large to represent localized concentrations near historic source areas or residual sources .
4) There are inherent uncertainties associated with cleanup time-frames predicted by the F&T model. These uncertainties include subsurface geology, geologic heterogeneity, aquifer parameters, recharge from precipitation, losses from surface water, source mass (before/after remediation), contaminant distribution, retardation of contaminants in the aquifer, etc.

Table 16
Comparison of Alternatives Summary
Bozeman Solvent Site

	Alternatives	Protectiveness	Compliance with ERCLs	Mitigation of Risk	Effectiveness and Reliability	Implementability and Practicability	Treatment or Resource Recovery Technologies	Years to Implementation	Capital Costs	Annual Operation & Maintenance Costs	
1	No Action	No	No	No	No	Yes	No	30	$0	$0	$0
2	In Situ Enhanced Biodegradation (On-site residual source)	Yes (when combined)	Yes (when combined), but will generate vinyl chloride in groundwater	Yes (residual on-site source material) No (soil vapor, off-site dissolved groundwater plume, alternate drinking water); Short-term risk associated with vinyl chloride and methane in soil vapor, but addressed with SVE system	Yes, but will temporarily generate COCs in groundwater and soil vapor	Yes	Yes	5	$580,680	$574,875	$3,547,330
3	In Situ Chemical Oxidation (On-site residual source)	Yes (when combined)	Yes (when combined)	Yes (on-site residual source material) No (soil vapor, off-site dissolved groundwater plume, alternate drinking water); Short-term risk associated with generation of metals and byproducts in groundwater	Yes, but lithology may limit installation of injection points; may generate metals and byproducts in groundwater	Yes	Yes	5	$2,027,091	$313,750	$3,463,974
4	Air Sparging (On-site residual source)	Yes (when combined)	Yes (when combined)	Yes (on-site residual source material) No (soil vapor, off-site dissolved groundwater plume, alternate drinking water); Short-term risk associated with an increase of PCE in soil vapor, but addressed with SVE system	Yes, but may increase PCE in soil vapor	Yes	Yes - SVE	10	$632,993	$307,125	$3,252,831
5	Hydraulic Control/Containment (On-site residual source)	Yes (when combined)	Yes (when combined)	Yes (on-site residual source material) No (soil vapor, off-site dissolved groundwater plume, alternate drinking water)	Yes, but COCs may rebound or COC decrease rates slow	Yes, but may require groundwater appropriations	Yes	10	$1,098,510	$231,694	$3,074,905
6	Passive Soil Venting (soil vapor)	Yes (when combined)	Yes (when combined)	Yes (soil vapor) No (on-site residual source material, off-site dissolved groundwater plume, alternate drinking water)	Yes, dependent upon changes in barometric pressure and groundwater level fluctuations	Yes	No	10	$76,488	$63,188	$615,490
7	Soil Vapor Extraction (soil vapor)	Yes (when combined)	Yes (when combined)	Yes (soil vapor) No (on-site residual source material, off-site dissolved groundwater plume, alternate drinking water)	Yes	Yes	Yes	5	$104,628	$96,375	$545,997
8	New or Deeper Replacement Drinking Water Wells (alternate drinking water)	Yes (when combined)	Yes (when combined)	Yes (off-site alternate drinking water) No (on-site residual source material, on-site sub-slab soil vapor, off-site dissolved plume)	Yes, but depends on acquiring drinking water source that meets MCLs and secondary MCLs	Yes	No	30	$208,518	$10,000	$329,418
9	Point-of-Use Treatment Systems (alternate drinking water)	Yes (when combined)	Yes (when combined)	Yes (off-site alternate drinking water) No (on-site residual source material, soil vapor, off-site dissolved groundwater plume)	Yes, but depends on proper operation and maintenance of the system	Yes	Yes	30	$73,905	$32,075	$702,590
10	Connection to City Water (alternate drinking water)	Yes (when combined)	Yes (when combined)	Yes (off-site alternate drinking water) No (on-site residual source material, soil vapor, off-site dissolved groundwater plume)	Yes	Maybe - requires annexation into City, easements	No	30	$3,910,888	$1,250	$3,935,388
11	Community Water System (alternate drinking water)	Yes (when combined)	Yes (when combined)	Yes (off-site alternate drinking water) No (on-site residual source material, soil vapor, off-site dissolved groundwater plume)	Yes, but depends on acquiring drinking water source that meets MCLs and secondary MCLs	Maybe - requires groundwater appropriations, easements, and property acquisition	No	30	$1,026,333	$37,500	$1,761,349
12	Plume Migration Control Pump & Treat (off-site dissolved groundwater plume)	Yes (when combined)	Yes (when combined)	Yes (off-site dissolved groundwater plume control) No (on-site residual source material, soil vapor, alternate drinking water)	Yes, but COCs may rebound or COC decrease rates slow	Yes, requires groundwater appropriations	Yes	25	$2,565,016	$211,625	$6,250,073
13	Plume Remediation Pump and Treat (off-site dissolved groundwater plume)	Yes (when combined)	Yes (when combined)	Yes (off-site dissolved groundwater plume control) No (on-site residual source material, soil vapor, alternate drinking water)	Yes, but COCs may rebound or COC decrease rates slow	Yes, requires groundwater appropriations	Yes	16	$3,382,673	$306,258	$7,229,604
14	Monitored Natural Attenuation (off-site dissolved groundwater plume)	Yes (when combined)	Yes (when combined)	Yes (long-term when combined)	Yes	Yes	No	30	$100,765	$53,375	$793,013

Table 17
Trench and Excavation Scenarios Requiring Fresh Air Mechanical Ventilation
Bozeman Solvent Site

Trench/Excavation Length Up to 70 feet					
		Width (feet)			
		3	6	9	12
Depth (feet)	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				

Trench/Excavation Length Between 70 and 100 feet					
		Width (feet)			
		3	6	9	12
Depth (feet)	1				
	2				
	3				
	4				
	5				
	6				
	7				
	8				
	9				
	10				
	11				
	12				

Notes:

Trenches and Excavations Requiring Fresh Air Mechanical Ventilation

Trenches and Excavations Not Requiring Fresh Air Mechanical Ventilation

Trench and Excavation Length limited to 100 feet.

From: Trihydro, 2011

Table 18
Selected Remedy Cost Summary and Present Worth Value Summary
Bozeman Solvent Site

	Alternatives	Years to Implementation	Capital Cost		Annual O&M Costs	Estimated Present Worth Cost at 3%
2	In Situ Enhanced Biodegradation (On-site residual source)	5	$914,571		$574,875	$3,547,330
7	Soil Vapor Extraction (soil vapor)	5	$104,628		$96,375	$545,997
8	New or Deeper Replacement Drinking Water Wells (alternate drinking water)	30	$208,518		$10,000	$329,418
14	Monitored Natural Attenuation (off-site dissolved groundwater plume)	30	$100,765		$83,188	$793,013
	Common Elements -					
	Institutional Controls	30	$6,813			$6,813
	Connection to City Water	30	$97,875		$1,250	$122,376
	Long-Term Monitoring	30		Years 1-5	$35,000	$531,302
				Years 6-30	$24,700	
					TOTAL	**$5,876,249**

Note: Total present worth cost calculated at 3% over number of years to implementation.
O&M - Operation and Maintenance

* - Specific costs developed for MNA include sampling costs associated with long-term monitoring for evaluation of remedy effectiveness, since they will likely be conducted at the same time.

APPENDIX A

ENVIRONMENTAL REQUIREMENTS, CRITERIA, OR LIMITATIONS
BOZEMAN SOLVENT SITE
August 2011

Remedial actions undertaken pursuant to the Comprehensive Environmental Cleanup and Responsibility Act (CECRA), §§ 75-10-701, et seq., MCA, must "attain a degree of cleanup of the hazardous or deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment." Section 75-10-721(1), MCA. Additionally, §§ 75-10-721(2)(a) and (b), MCA, provide that the Montana Department of Environmental Quality (DEQ) must require cleanup consistent with applicable state or federal environmental requirements, criteria, or limitations (ERCLs). The statute also provides for DEQ consideration of substantive ERCLs that are relevant to the site conditions. In order to assist DEQ in ensuring that the required cleanup is consistent with ERCLs, DEQ identifies those laws or regulations that have been promulgated which are applicable or relevant to the facility. ERCLs are grouped into three categories: contaminant-specific, location-specific, and action-specific. Contaminant-specific requirements are those that establish an allowable level or concentration of a hazardous or deleterious substance in the environment or that prescribe a level or method of treatment for a hazardous or deleterious substance. Location-specific requirements are those that serve as restrictions on the concentration of a hazardous or deleterious substance or the conduct of activities solely because they are in specific locations. Action-specific requirements are those that are relevant to implementation of a particular remedy. Action-specific requirements do not in themselves determine the remedy but rather indicate the manner in which the remedy must be implemented. Some ERCLs could be categorized in more than one way; in this case, they are generally not duplicated within the document.

CECRA defines cleanup requirements as only state and federal ERCLs. Remedial designs, implementation, operation, and maintenance must, nevertheless, comply with all other applicable laws, including local, state, and federal. Many such laws, while not strictly environmental, have environmental impacts. It remains the responsibility of the persons implementing the remedy to identify and comply with all laws.

Many requirements listed here are promulgated as identical or nearly identical requirements in both federal and state law, usually pursuant to a delegated environmental program administered by the Environmental Protection Agency and the states, such as the requirements of the federal Clean Water Act and the Montana Water Quality Act. ERCLs and other laws which are unique to state law are also identified.

Within this document, DEQ has identified applicable or relevant state and federal environmental requirements for the final remedial actions at the Bozeman Solvent Site. The description of applicable and relevant federal and state requirements that follows includes summaries of the legal requirements which attempt to set out the requirement in a reasonably concise fashion that is useful in evaluating compliance with the requirement. These descriptions are provided to allow the user a basic indication of the requirement without having to refer back to the statute or regulation itself. However, in the event of any inconsistency between the law itself and the summaries provided in this document, the actual requirement is ultimately the requirement as set out in the law, rather than

any paraphrase of the law provided here.

ACTION SPECIFIC REQUIREMENTS

Point Source Controls: Section 402 of the Clean Water Act, 33 USC § 1342, *et seq.*, authorizes the issuance of permits for the "discharge" of any "pollutant." This includes storm water discharges associated with "industrial activity." *See*, 40 CFR § 122.1(b)(2)(iv). "Industrial activity includes inactive mining operations that discharge storm water contaminated by contact with or that has come into contact with any overburden, raw material, intermediate products, finished products, byproducts or waste products located on the site of such operations, *see*, 40 CFR § 122.26(b)(14)(iii); landfills, land application sites, and open dumps that receive or have received any industrial wastes including those subject to regulation under RCRA subtitle D, *see*, 40 CFR § 122.26(b)(14)(v); and construction activity including clearing, grading, and excavation activities, *see*, 40 CFR § 122.26(b)(14)(x). Because the State of Montana has been delegated the authority to implement the Clean Water Act, these requirements are enforced in Montana through the Montana Pollutant Discharge Elimination System (MPDES) (ARM 17.30.1342-1344). The remedy identified in the Record of Decision does not indicate a point source of water contamination will be retained or created by any remediation activity. However, if such a point source is retained or created, applicable Clean Water Act standards, including the requirement to properly operate and maintain all facilities and systems of treatment and control, would apply to those discharges. See ARM 17.30.1201 et seq., (standards) and ARM 17.30.1301 et seq. (permits).

Dredge and Fill Requirements: The selected remedy does not involve depositing dredge and fill material into water of the United States. Therefore, remediation activities associated with waste removal and creek restoration which requires a Section 404 Permit are not anticipated.

Air Quality Regulations (Applicable): Dust suppression and control of certain substances likely to be released into the air as a result of earth moving, transportation and similar actions may be necessary to meet air quality requirements. Additional air quality regulations under the state Clean Air Act, §§ 75-2-101 et seq., MCA, promulgated pursuant to the Clean Air Act, 42 U.S.C. §§ 7401, et seq., are discussed below. These standards are applicable to cleanup activities.

ARM 17.8.220 (Applicable). Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

ARM 17.8.223 (Applicable). PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

Ambient air standards under section 109 of the Clean Air Act are also promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the Bozeman Solvent Site in connection with any cleanup action, these standards would also be applicable. See ARM 17.8.210, 17.8.211, 17.8.212, 17.8.213, and 17.8.214.

ARM 17.8.304 and 17.8.308 (Applicable) provide that no person shall cause or authorize the production, handling, transportation or storage of any material; or cause or authorize the use of any street, road, or parking lot; or operate a construction site or demolition project, unless reasonable precautions to control emissions of airborne particulate matter are taken. Emissions of airborne particulate matter must be controlled so that they do not "exhibit an opacity of twenty percent (20%) or greater averaged over six consecutive minutes."

ARM 17.24.761 (Relevant) specifies a range of measures for controlling fugitive dust emissions during mining and reclamation activities and requires that a fugitive dust control program be implemented. Some of these measures could be considered relevant to control fugitive dust emissions in connection with excavation, earth moving and transportation activities conducted as part of the remedy at the site. Such measures include, for example, paving, watering, chemically stabilizing, or frequently compacting and scraping roads, promptly removing rock, soil or other dust-forming debris from roads, restricting vehicles speeds, revegetating, mulching, or otherwise stabilizing the surface of areas adjoining roads, restricting unauthorized vehicle travel, minimizing the area of disturbed land, and promptly revegetating regraded lands.

Groundwater Act (Applicable): § 85-2-505, MCA, precludes the wasting of groundwater. Any well producing waters that contaminate other waters must be plugged or capped, and wells must be constructed and maintained so as to prevent waste, contamination, or pollution of groundwater.

Section 85-2-516, MCA (Applicable) states that within 60 days after any well is completed a well log report must be filed by the driller with the Montana Bureau of Mines and Geology.

ARM 17.30.641 (Applicable) provides standards for sampling and analysis of water.

ARM 17.30.646 (Applicable) requires that bioassay tolerance concentrations be determined in a specified manner.

ARM 36.21.670-678 and 810 (Applicable) specifies certain requirements that must be fulfilled when abandoning monitoring wells.

Storm Water Runoff – ARM 17.30.1341 to 1344 (Applicable) requires a Storm Water Discharge General Permit for stormwater point sources. Generally, the permit requires the permittee to implement Best Management Practices (BMP) and to take all reasonable steps to minimize or prevent any discharge which has a reasonable likelihood of adversely affecting human health or the environment. However, if there is evidence indicating potential or realized impacts on water quality due to any storm water discharge associated with the activity, additional protections may be required.

ARM 17.24.633 (Relevant): All surface drainage from a disturbed area must be treated by the best technology currently available.

RCRA Subtitle C Requirements and corresponding State Requirements
RCRA, 42 U.S.C. §§ 6901 et seq., (Applicable, as incorporated by the Montana Hazardous Waste Act), the Montana Hazardous Waste Act, §§ 75-10-401 et seq., MCA, (Applicable) and the regulations under these acts establish a regulatory structure for the generation, transportation, treatment, storage and disposal of hazardous wastes. These requirements are applicable to any substances or actions at the Bozeman Solvent Site that involve the active management of hazardous wastes.

Wastes may be designated as hazardous by either of two methods: listing or demonstration of a hazardous characteristic. Listed wastes are the specific types of wastes determined by EPA to be hazardous as identified in 40 CFR Part 261, Subpart D (40 CFR 261.30 - 261.33) (Applicable, as incorporated by the Montana Hazardous Waste Act). Listed wastes are designated hazardous by virtue of their origin or source, and must be managed as hazardous wastes. Characteristic wastes are those that by virtue of concentrations of hazardous constituents demonstrate the characteristic of ignitability, corrosivity, reactivity or toxicity, as described at 40 CFR Part 261, Subpart C (Applicable, as incorporated by the Montana Hazardous Waste Act).

The waste generator has responsibility for determining if a waste is a RCRA hazardous waste (40 CFR 262.11). This listed waste determination is generally done using generator knowledge of the products and processes used. In a June 7, 1993 letter, DEQ advised that it was American Store's responsibility to determine whether the PCE contaminated soils and groundwater are RCRA listed hazardous waste. In a July 14, 1995 letter, American Stores indicated that because it had identified other potential sources of PCE, it did not believe the contaminated soil impacted by sewer leakage was properly characterized as a RCRA listed hazardous waste from dry cleaning. Based on that information, in July 1995, DEQ agreed with the determination that the PCE was not a 'F' listed waste based on the knowledge that the PCE was found in a septic system and sewer line for which several business establishments are connected. DEQ also acknowledged that while there was an active drycleaner at the BSC connected to the sewer line, there were also automotive repair facilities which may also have used PCE. Based on those determinations, the Bozeman Solvent Site does not contain listed hazardous waste and RCRA listed waste regulations do not apply. However, RCRA requirements are specified herein to address any potential contaminants that may be characterized as hazardous; characteristic waste determinations are made through sampling and analysis of contaminated materials, including but not limited to drill cuttings, excavation spoils, purge water, and granular activated carbon (GAC) filter media.

The RCRA regulations at 40 CFR Part 262 (Applicable, as incorporated by the Montana Hazardous Waste Act) establish standards that apply to generators of hazardous waste. These standards include requirements for obtaining an EPA identification number and maintaining certain records and filing certain reports.

The RCRA regulations at 40 CFR Part 263 (Applicable, as incorporated by the Montana Hazardous Waste Act) establish standards that apply to transporters of hazardous waste. These

standards include requirements for immediate action for hazardous waste discharges.

The regulations at 40 CFR 264, Subpart B (Applicable, as incorporated by the Montana Hazardous Waste Act) establish general facility requirements. These standards include requirements for general waste analysis, security and location standards.

Because the remedy does not include a RCRA-regulated solid waste management unit or the use of piles, land treatment units, staging piles, or corrective action management units, the regulations at 40 CFR 264, Subparts F, G, L, M, and S and 40 CFR 264.554 are not identified. Because there is no listed hazardous waste at the Bozeman Solvent Site, Land Disposal Restrictions (40 CFR Part 268) and corresponding federal and state regulations have not been identified. Similarly, 40 CFR Part 270 outlining permit requirements (and the corresponding state regulations) have not been identified.

40 CFR Part 264, Subpart I (Applicable, as incorporated by the Montana Hazardous Waste Act) apply to owners and operators of facilities that store hazardous waste in containers. These regulations are applicable to any storage of purge water or other media containing hazardous waste. The related provisions of 40 CFR 261.7 regarding residues of hazardous waste in empty containers are also applicable, as incorporated by the Montana Hazardous Waste Act.

The Montana Hazardous Waste Act, §§ 75-10-401 et seq., MCA (Applicable) and regulations under this act establishes a regulatory structure for the generation, transportation, treatment, storage and disposal of hazardous wastes. These requirements are applicable to substances and actions at the Site that involve listed and characteristic hazardous wastes.

ARM 17.53.501-502 (Applicable) adopts the equivalent of RCRA regulations at 40 CFR Part 261, establishing standards for the identification and listing of hazardous wastes, including standards for recyclable materials and standards for empty containers, with certain State exceptions and additions.

ARM 17.53.601-604 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 262, establishing standards that apply to generators of hazardous waste, including standards pertaining to the accumulation of hazardous wastes, with certain State exceptions and additions.

ARM 17.53.701-708 (Applicable) adopts the equivalent to RCRA regulations at 40 CFR Part 263, establishing standards that apply to transporters of hazardous waste, with certain State exceptions and additions.

Section 75-10-422 MCA (Applicable) prohibits the unlawful disposal of hazardous wastes.

Montana Solid Waste Management Act and regulations, §§ 75-10-201, et seq., MCA, ARM 17.50.501 et seq. (Applicable) - Regulations promulgated under the Solid Waste Management Act, §§ 75-10-201, et seq., MCA, and pursuant to the federal Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, 42 U.S.C. §§ 6901 et seq. (RCRA

Subtitle D) specify requirements that apply to the location of any solid waste management facility. At the Bozeman Solvent Site, the remedy does not include the requirement to construct such a facility. The only solid waste anticipated to be generated during implementation of the remedy is incidental investigation-derived waste (IDW), the substrate material typically contained in barrels or drums (comprised of emulsified vegetable oil), and personal protective equipment (PPE). Non-hazardous solid waste, such as IDW and PPE, can be double-bagged in a plastic bag and placed in a waste disposal dumpster for collection and appropriate disposal at an off-site licensed solid waste facility.

Section 75-10-212, MCA, (Applicable) prohibits dumping or leaving any debris or refuse upon or within 200 yards of any highway, road, street, or alley of the State or other public property, or on privately owned property where hunting, fishing, or other recreation is permitted. However, the restriction relating to privately owned property does not apply to the owner, his agents, or those disposing of debris or refuse with the owner's consent.

<u>Underground Injection Control Program</u>
All injection wells are regulated under the Underground Injection Control Program in accordance with 40 CFR 144 and 146 (Applicable) which set forth the standards and criteria for the injection of substances into aquifers. Wells are classified as Class I through V, depending on the location and the type of substance injected. For all classes, no owner may construct, operate or maintain an injection well in a manner that results in the contamination of an underground source of drinking water at levels that violate MCLs or otherwise adversely affect the health of persons. Each classification may also contain further specific standards, depending on the classification. Compliance with these regulations may require application to the EPA's Underground Injection Control Program for a permit to conduct in-situ enhanced bioremediation described in the Record of Decision.

<u>Reclamation Requirements (Relevant):</u> Certain portions of the Montana Strip and Underground Mining Reclamation Act and Montana Metal Mining Act as outlined below are relevant for activities at the Bozeman Solvent Site. While no mining activities are occurring at the Site, these requirements are relevant for the management and reclamation of areas disturbed by excavation, grading, or similar actions. Typically reclamation requirements include revegetation, grading, etc. However, at the Bozeman Solvent Site, most of the excavation will occur on a commercial property that has existing pavement and concrete. In those areas, the person conducting the remedial actions must return the property to its pre-excavation condition. For those areas at the facility which require revegetation, grading, etc., the following are relevant when developing the reclamation and revegetation plan.

Section 82-4-231, MCA: Requires operators to reclaim and revegetate affected lands using the most modern technology available. Operators must grade, backfill, topsoil, reduce high walls, stabilize subsidence, control water, minimize erosion, subsidence, land slides, and water pollution.

Section 82-4-233, MCA: Operators must plant vegetation that will yield a diverse, effective, and

permanent vegetative cover of the same seasonal variety native to the area and capable of self-regeneration.

Section 82-4-336, MCA: Disturbed areas must be reclaimed to the utility and stability comparable to areas adjacent.

ARM 17.24.519: Pertinent areas where excavation occurs will be regraded to minimize settlement.

ARM 17.24.631(1), (2), (3)(a) and (b): Disturbances to the prevailing hydrologic balance will be minimized. Changes in water quality and quantity, in the depth to groundwater and in the location of surface water drainage channels will be minimized, to the extent consistent with the selected remedial action. Other pollution minimization devices must be used if appropriate, including stabilizing disturbed areas through land shaping, diverting runoff, planting quickly germinating and growing stands of temporary vegetation, regulating channel velocity of water, lining drainage channels with rock or vegetation, mulching, and control of acid-forming, and toxic-forming waste materials.

ARM 17.24.633: Surface drainage from a disturbed area must be treated by the best technology currently available (BTCA). Treatment must continue until the area is stabilized.

ARM 17.24.635 through 17.24.637: Set forth requirements for temporary and permanent diversions.

ARM 17.24.638: Sediment control measures must be implemented during operations.

ARM 17.24.640: Discharges from diversions must be controlled to reduce erosion and enlargement of stream channels, and to minimize disturbance of the hydrologic balance.

ARM 17.24.641: Practices to prevent drainage from acid or toxic forming spoil material into ground and surface water will be employed.

ARM 17.24.643 through 17.24.646: Provisions for groundwater protection, groundwater recharge protection, and groundwater and surface water monitoring.

ARM 17.24.701 and 702: Requirements for redistributing and stockpiling of soil for reclamation. Also outlines practices to prevent compaction, slippage, erosion, and deterioration of biological properties of soil.

ARM 17.24.703: When using materials other than, or along with, soil for final surfacing in reclamation, the operator must demonstrate that the material (1) is at least as capable as the soil of supporting the approved vegetation and subsequent land use; and (2) the medium must be the best available in the area to support vegetation. Such substitutes must be used in a manner consistent with the requirements for redistribution of soil in ARM 17.24.701 and 702.

ARM 17.24.711: Requires that a diverse, effective and permanent vegetative cover of the same seasonal variety and utility as the vegetation native to the area of land to be affected must be established. This provision would not be relevant and appropriate in certain instances, for example, where there is dedicated development.

ARM 17.24.713: Seeding and planting of disturbed areas must be conducted during the first appropriate period for favorable planting after final seedbed.

ARM 17.24.714: Mulch or cover crop or both must be used until adequate permanent cover can be established.

ARM 17.24.716: Establishes method of revegetation.

ARM 17.24.717: Relates to the planting of trees and other woody species if necessary, as provided in § 82-4-233, MCA, to establish a diverse, effective, and permanent vegetative cover.

ARM 17.24.718: Requires soil amendments if necessary to establish a permanent vegetative cover.

ARM 17.24.721: Specifies that rills or gullies must be stabilized and the area reseeded and replanted if the rills and gullies are disrupting the reestablishment of the vegetative cover or causing or contributing to a violation of water quality standards for a receiving stream.

ARM 17.24.723: Requires periodic monitoring of vegetation, soils, water, and wildlife.

ARM 17.24.724: Specifies how revegetation success is measured.

ARM 17.24.726: Sets the required methods for measuring vegetative success.

ARM 17.24.731: If toxicity to plants or animals is suspected, comparative chemical analyses may be required.

ARM 17.24.751: Measures to prevent degradation of fish and wildlife habitat will be employed.

ARM 17.24.761: This specifies fugitive dust control measures that will be employed during excavation and construction activities to minimize the emission of fugitive dust.

<u>Noxious Weeds (Applicable):</u> Section 7-22-2101(8)(a), MCA defines "noxious weeds" as any exotic plant species established or that may be introduced in the state which may render land unfit for agriculture, forestry, livestock, wildlife, or other beneficial uses or that may harm native plant communities and that is designated: (i) as a statewide noxious weed by rule of the department of agriculture; or (ii) as a district noxious weed by a district weed board, following public notice of intent and a public hearing. Designated noxious weeds are listed in ARM

4.5.206 through 4.5.210 and must be managed consistent with weed management criteria developed under § 7-22-2109(2)(b), MCA. Section 7-22-2152, MCA, requires that any person proposing certain actions including but not limited to a solid waste facility, a highway or road, a commercial, industrial, or government development, or any other development that needs state or local approval and that results in the potential for noxious weed infestation within a district shall notify the district weed board at least 15 days prior to the activity. The board will require that the areas be seeded, planted, or otherwise managed to reestablish a cover of beneficial plants. The person committing the action shall submit to the board a written plan specifying the methods to be used to accomplish revegetation at least 15 days prior to the activity. The plan must describe the time and method of seeding, fertilization practices, recommended plant species, use of weed-free seed, and the weed management procedures to be used. The plan is subject to approval by the board, which may require revisions to bring the revegetation plan into compliance with the district weed management plan. The activity for which notice is given may not occur until the plan is approved by the board and signed by the presiding officer of the board and by the person or a representative of the agency responsible for the action. The signed plan constitutes a binding agreement between the board and the person or agency. The plan must be approved, with revisions if necessary, within 10 days of receipt by the board.

CONTAMINANT SPECIFIC REQUIREMENTS

GROUNDWATER

The Safe Drinking Water Act, 42 USC §§ 300f et seq., and the National Primary Drinking Water Regulations (40 CFR Part 141) (Relevant) establish maximum contaminant levels (MCLs) and maximum contaminant level goals (MCLGs) for contaminants in drinking water distributed in public water systems. These requirements were evaluated during this ERCLs analysis in conjunction with the groundwater classification standards promulgated by the State of Montana. The MCLs and MCLGs are identified because the groundwater in the area of the Bozeman Solvent Site is a source of drinking water and is currently being used as a drinking water source. There are numerous commercial, industrial, and residential wells within the Bozeman Solvent Site that use the groundwater.

Use of these standards for this action is fully supported by EPA regulations and guidance. The Preamble to the National Contingency Plan (NCP) clearly states that MCLs are relevant for groundwater that is a current or potential source of drinking water (55 Fed.Reg. 8750, March 8, 1990), and this determination is further supported by requirements in the regulations governing conduct of the RI/FS studies found at 40 CFR § 300.430(e)(2)(i)(B). EPA's guidance on Remedial Action for Contaminated Groundwater at Superfund Sites states that "MCLs developed under the Safe Drinking Water Act generally are ARARs [the federal equivalent of ERCLs] for current or potential drinking water sources." MCLGs which are above zero are relevant under the same conditions (55 Fed.Reg. 8750-8752, March 8, 1990). See also, State of Ohio v. EPA, 997 F.2d 1520 (D.C. Cir. 1993), which upholds EPA's application of MCLs and non-zero MCLGs as ARAR standards for groundwater which is a potential drinking water source.

Chemical	MCLG	MCL

tetrachloroethene (PCE)	0[1]	5 ug/l
trichloroethene (TCE)	0[1]	5 ug/l
trans-1,2 dichloroethene	100 ug/l	100 ug/l
cis-1,2 dichloroethene	70 ug/l	70 ug/l
vinyl chloride	0[1]	2 ug/l

[1] An MCLG of zero is not an appropriate standard for Superfund site cleanups.

In addition, the Secondary Maximum Contaminant Levels (SMCLs) specified in 40 CFR Part 143.3 are relevant requirements which are ultimately to be attained by the remedy for the Bozeman Solvent Site. This regulation contains standards for iron, manganese, color, odor, and corrosivity that are relevant to the remedial actions. As discussed in Section 11.2.4 of the Decision Summary, DEQ may require the new or replacement wells to be sampled for other water quality parameters, such as iron and manganese.

The Montana Water Quality Act, § 75-5-605, MCA (Applicable) provides that it is unlawful to cause pollution of any state waters and § 75-6-112, MCA (Applicable) provides that it is unlawful to discharge drainage or other waste that will cause pollution of state waters used as a source for a public water supply or for domestic use as well as prohibits other unlawful actions.

Section 75-5-605, MCA (Applicable) also states that it is unlawful to place or cause to be placed any wastes where they will cause pollution of any state waters.

Section 75-5-303, MCA (Applicable) states that existing uses of state waters and the level of water quality necessary to protect the uses must be maintained and protected.

ARM 17.30.1006 (Applicable) classifies groundwater into Classes I through IV based upon its specific conductance and establishes the groundwater quality standards applicable with respect to each groundwater classification. Class I is the highest quality class; class IV the lowest. Based on its specific conductance and that the groundwater requires little or no treatment to maintain its beneficial use, groundwater at the Bozeman Solvent Site has been classified as Class I groundwater.

Concentrations of substances in groundwater within Class I may not exceed the human health standards for groundwater listed in DEQ Circular DEQ-7, Montana Numeric Water Quality Standards, August 2010 (Applicable). In addition, no increase of a parameter may cause a violation of § 75-5-303, MCA (Applicable). For concentrations of parameters for which human health standards are not listed in DEQ-7, ARM 17.30.1006 allows no increase of a parameter to a level that renders the waters harmful, detrimental or injurious to the beneficial uses listed for that class of water.

Human health standards for the primary contaminants of concern (COCs) are listed below and are based on the standards outlined in DEQ-7. However, compliance with all DEQ-7 standards

is required and remedial actions must meet the DEQ-7 standards for all contaminants at the Site, including any breakdown products generated during remedial actions. In addition, as discussed in Section 11.2.4 of the Decision Summary, DEQ may require the new or replacement wells to be sampled for other water quality parameters, such as iron and manganese.

Chemical	DEQ-7 Standard for Groundwater
tetrachloroethene (PCE)	5 ug/l
trichloroethene (TCE)	5 ug/l
trans-1,2 dichloroethene	100 ug/l
cis-1,2 dichloroethene	70 ug/l
vinyl chloride	0.2 ug/l

ARM 17.30.1011 (Applicable) provides that any groundwater whose existing quality is higher than the standard for its classification must be maintained at that high quality in accordance with § 75-5-303, MCA, and ARM Title 17, chapter 30, subchapter 7.

An additional concern with respect to ERCLs for groundwater is the impact of groundwater upon surface water. If significant loadings of contaminants from groundwater sources to any surface water body contribute to the inability of the surface water to meet its applicable class standards, (i.e., the DEQ-7 levels described in the Surface Water section below), then alternatives to alleviate such groundwater loading must be evaluated and, if appropriate, implemented.

SURFACE WATER

The Bozeman Solvent Site encompasses a portion of the East Gallatin River. Groundwater in the unconfined aquifer is generally interconnected with the East Gallatin River and a series of natural streams and irrigation ditches.

The federal Clean Water Act, 33 U.S.C. § 1251, et seq., provides the authority for each state to adopt water quality standards (40 CFR Part 131) designed to protect beneficial uses of each water body and requires each state to designate uses for each water body. Under the state Water Quality Act, §§ 75-5-101, et seq., MCA, Montana has promulgated regulations, ARM 17.30.601 et seq., (Applicable), to protect, maintain, and improve the quality of surface waters in the state. The State has the authority to adopt water quality standards designed to protect beneficial uses of each water body and to designate uses for each water body.

Montana's regulations classify State waters according to quality, place restrictions on the discharge of pollutants to State waters, and prohibit degradation of State waters.

Pursuant to this authority and the criteria established by Montana surface water quality regulations, ARM 17.30.601, et seq., Montana has established the Water-Use Classification system. ARM 17.30.610(1)(a) (Applicable) provides that the East Gallatin River is classified “B-2” for water use.

ARM 17.30.624 (Applicable) provides the classification standards and beneficial uses for the B-2 classification and provides that concentrations of carcinogenic, bioconcentrating, toxic, or harmful parameters in the water may not exceed DEQ-7 standards. The section also provides the specific water quality standards for water classified as B-2 which must be met.

In addition, the following criteria apply:

1. Dissolved oxygen concentration must not be reduced below the levels given in DEQ-7, as provided in the following table (in milligrams per liter)

	Early Life Stages[1,2]	Other Life Stages
30 Day Mean	n/a[3]	6.5
7 Day Mean	9.5 (6.5)	n/a[3]
7 Day Mean Minimum	n/a[3]	5.0
1 Day Minimum[4]	8.0 (5.0)	4.0

1 These are water column concentrations recommended to achieve the required inter-gravel dissolved oxygen concentrations shown in parentheses. For species that have early life stages exposed directly to the water column, the figures in parentheses apply.
2 Includes all embryonic and larval stages and all juvenile forms of fish to 30 days following hatching.
3 not applicable
4 All minima should be considered instantaneous concentrations to be achieved at all times

2. Induced variation of hydrogen ion concentration (pH) within the range of 6.5 to 9.0 must be maintained less than 0.5 pH unit. Natural pH outside this range must be maintained without change. Natural pH above 7.0 must be maintained above 7.0;
3. The maximum allowable increase above naturally occurring turbidity is 5 nephelometric turbidity units, except as permitted by § 75-5-318, MCA;
4. Temperature increases must be kept within prescribed limits;
5. No increase is allowed above naturally occurring concentrations of sediment, settleable solids, oils, or floating solids which will or is likely to create a nuisance or render the waters harmful, detrimental, or injurious to public health, recreation, safety, welfare, livestock, wild animals, birds, fish or other wildlife;
6. True color must be kept within specified limits; and
7. E-coli must be kept below specified limits.

For the primary COCs, the DEQ-7 surface water standards are listed below. However, compliance with all DEQ-7 standards is required. If both Aquatic Life Standards and Surface Water Human Health Standards exist for the same analyte, the more restrictive of these values

will be used as the applicable numeric standard.

Chemical	DEQ-7 Standard for Surface Water
tetrachloroethene (PCE)	5 ug/l
trichloroethene (TCE)	5 ug/l
trans-1,2 dichloroethene	100 ug/l
cis-1,2 dichloroethene	70 ug/l
vinyl chloride	0.25 ug/l

Creeks, rivers, ditches, and certain other bodies of surface water must meet these requirements.[1]

ARM 17.30.637 (Applicable), requires state surface waters to be free from substances attributable to municipal, industrial, agricultural practices, or other discharges that will:

1. settle to form objectionable sludge deposits or emulsions beneath the surface of the water or upon adjoining shorelines;
2. create floating debris, scum, a visible oil film (or be present in concentrations at or in excess of 10 milligrams per liter) or globules of grease or other floating materials;
3. produce odors, colors or other conditions as to which create a nuisance or render undesirable tastes to fish flesh or make fish inedible;
4. create concentrations or combinations of materials which are toxic or harmful to human, animal, plant or aquatic life; and
5. create conditions which produce undesirable aquatic life.

ARM 17.30.637 also states that no waste may be discharged and no activities conducted which, either along or in combination with other waste activities, will cause violation of surface water quality standards.

ARM 17.30.705 (Applicable): This provides that for any surface water, existing and anticipated uses and the water quality necessary to protect these uses must be maintained and protected unless degradation is allowed under the nondegradation rules at ARM 17.30.708.

AIR QUALITY

The Clean Air Act (42 USC §§ 7401 et seq.) provides limitations on air emissions resulting from cleanup activities or emissions resulting from wind erosion of exposed hazardous substances. Sections 75-2-101, et seq, MCA (Applicable) provides that state emission standards are enforceable under the Montana Clean Air Act.

ARM 17.8.204 and 206 (Applicable) This provision establishes monitoring, data collection and

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1 As provided under ARM 17.30.602(33), “'surface waters' means any waters on the earth's surface, including, but not limited to, streams, lakes, ponds, and reservoirs; and irrigation and drainage systems discharging directly into a stream, lake, pond, reservoir or other surface water. Water bodies used solely for treating, transporting or impounding pollutants shall not be considered surface water.”

analytical requirements to ensure compliance with ambient air quality standards and requires compliance with the Montana Quality Assurance Project Plan except when more stringent requirements are determined by DEQ to be necessary.

ARM 17.8.220 (Applicable). Settled particulate matter shall not exceed a thirty (30) day average of 10 grams per square meter.

ARM 17.8.223 (Applicable). PM-10 concentrations in ambient air shall not exceed a 24 hour average of 150 micrograms per cubic meter of air and an annual average of 50 micrograms per cubic meter of air.

Ambient air standards are also promulgated for carbon monoxide, hydrogen sulfide, nitrogen dioxide, sulfur dioxide, and ozone. If emissions of these compounds were to occur at the Bozeman Solvent Site in connection with any remedial action, these standards would also be applicable. See ARM 17.8.210, 17.8.211, 17.8.212, 17.8.213, and 17.8.214.

METHANE

The enhanced bioremediation remedy has the potential to generate methane. While the enhanced bioremediation system is not a solid waste management facility, certain regulations from the Montana Solid Waste Act can be used to determine when the soil vapor extraction system associated with mitigating the methane must be used. Specifically, ARM 17.50.1106 (Relevant) specifies the concentration of methane gas generated by a solid waste facility cannot exceed 25 percent of the lower explosive limit for methane in facility structures, excluding gas control or recovery system components, and cannot exceed the lower explosive limit for methane at the facility property boundary.

LOCATION SPECIFIC REQUIREMENTS

The Endangered Species Act (Relevant): This statute and implementing regulations (16 U.S.C. § 1531 et seq., 50 CFR Part 402, 40 CFR § 6.302(h), and 40 CFR § 257.3-2) require that any federal activity or federally authorized activity may not jeopardize the continued existence of any threatened or endangered species or destroy or adversely modify a critical habitat. Compliance with this requirement involves consultation with the U.S. Fish and Wildlife Service (USFWS) and a determination of whether there are listed or proposed species or critical habitats present at the Site, and, if so, whether any proposed activities will impact such wildlife or habitat. No threatened or endangered species or critical habitat has been identified at the Bozeman Solvent Site and no federal actions are anticipated. However, if any threatened or endangered species are subsequently encountered during remedial actions, consultation with the USFWS will occur.

Montana Nongame and Endangered Species Act, §§ 87-5-101 et seq (Applicable): Endangered species should be protected in order to maintain and to the extent possible enhance their numbers. These sections list endangered species, prohibited acts and penalties. See also, § 87-5-201, MCA, (Applicable) concerning protection of wild birds, nests and eggs; and ARM 12.5.201 (Applicable) prohibiting certain activities with respect to specified endangered species. No threatened or

endangered species or critical habitat has been identified at the Bozeman Solvent Site. However, if any threatened or endangered species or critical habitat are subsequently encountered during remedial actions, compliance with these ERCLs is required.

Migratory Bird Treaty Act (Relevant): This requirement (16 U.S.C. § 703 et seq.) establishes a federal responsibility for the protection of the international migratory bird resource and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that the cleanup of the Bozeman Solvent Site does not unnecessarily impact migratory birds. Specific mitigative measures may be identified for compliance with this requirement. If any migratory birds are encountered during remedial actions, consultation with the USFWS will occur.

Bald Eagle Protection Act (Relevant): This requirement (16 U.S.C. § 668 et seq.) establishes a federal responsibility for protection of bald and golden eagles, and requires continued consultation with the USFWS during remedial design and remedial construction to ensure that any cleanup of the Bozeman Solvent Site does not unnecessarily adversely affect the bald and golden eagle. To date, bald and golden eagles have not been identified at the Bozeman Solvent Site. However, if any bald or golden eagles are subsequently encountered during remedial actions, consultation with the USFWS will occur.

Protection of Wetlands Order (Relevant): Provisional Wetland Riparian Area Mapping for Bozeman (Montana Natural Heritage Program, June 2010) indicates there are wetlands along the East Gallatin River, Farmers Canal, and the “East” Stream. All are these areas are north of the BSC and no wetlands were identified at or adjacent to the BSC. The Record of Decision does not require nor anticipate any remedial actions that would negatively impact wetlands. However, because there are wetlands within the facility boundaries of the Bozeman Solvent Site, certain wetlands protection regulations are identified.

40 CFR Part 6, Appendix A, Executive Order No. 11,990 mandates that federal agencies and potentially responsible parties avoid, to the extent possible, the adverse impacts associated with the destruction or loss of wetlands and to avoid new construction in wetlands if a practicable alternative exists. Section 404(b)(1), 33 U.S.C. § 1344(b)(1) (Relevant) also prohibits the discharge of dredged or fill material into waters of the United States. Together, these requirements create a "no net loss" of wetlands standard.

Historic Sites, Buildings, Objects and Antiquities Act (Relevant): These requirements, found at 16 U.S.C. 461 et seq., provide that, in conducting an environmental review of a proposed action, the responsible official shall consider the existence and location of natural landmarks using information provided by the National Park Service pursuant to 36 CFR 62.6(d) to avoid undesirable impacts upon such landmarks. To date, no such landmarks are identified in the area. Therefore, no further actions are required to comply with this requirement.

Resource Conservation and Recovery Act (Relevant): 40 CFR 264.18 provides location standards for owners and operators of hazardous waste management units. Portions of new management units must not be located within 200 feet of a fault which has had displacement in Holocene time and

management units in or near a 100 year floodplain must be designed, constructed, operated, and maintained to avoid washout.

Floodplains and Streambed Preservation
The northern portion of the Bozeman Solvent Site encompasses the East Gallatin River and its 100-year floodplain; therefore, applicable or relevant ERCLs are identified. In addition, there are surface water bodies within the Bozeman Solvent which necessitates the identification of streambed requirements. However, it is not anticipated that the remedy will require work in the floodplain or streambed.

Fish and Wildlife Coordination Act (Relevant): These standards are found at 16 U.S.C. § 661 et seq. and 40 CFR 6 and require that federally funded or authorized projects ensure that any modification of any stream or other water body affected by a funded or authorized action provide for adequate protection of fish and wildlife resources. The regulations are relevant because there are surface water bodies within the Bozeman Solvent Site; however, no federal action is anticipated at the site and it is not anticipated that further actions are required to comply with this requirement.

Floodplain Management Order (Relevant): Executive Order 11988 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Implementing regulations for this executive order are found at 40 CFR 6. The executive order and regulations are relevant because a portion of the Bozeman Solvent Site is in a floodplain; however, no federal action is anticipated at the site and it is not anticipated that further actions are required to comply with this requirement. In addition, application of the Montana floodplain requirements (see below) addresses protection of the floodplain.

Montana Floodplain and Floodway Management Act and Regulations, §§ 76-5-401, et seq., MCA, ARM 36.15.601, et seq. (Applicable): The Floodway Management Act and regulations specify types of uses and structures that are allowed or prohibited in the designated 100-year floodway and floodplain.

Section 76-5-401, MCA and ARM 36.15.601 (Applicable) allow certain open-space uses in a floodway.

ARM 36.15.701 (Applicable) allow certain activities in the flood fringe.

ARM 36.15.605(2) and 36.15.703 (Applicable) prohibit certain uses anywhere in either the floodway or the flood fringe.

Section 76-5-402, MCA, (Applicable) allows uses in the floodplain outside the flood way.

Section 76-5-404, MCA (Applicable), establishes that it is unlawful to alter an artificial obstruction or designated floodway without a permit. This section applies to any remedial action

in the designated floodplain or designated floodway where such action requires more than maintenance. The substantive requirements of a Floodplain Development Permit are applicable to activities planned in the floodway.

The substantive requirements specify factors that must be considered in allowing diversions of the stream, changes in place of diversion of the stream, flood control works, new construction or alteration of artificial obstructions, or any other nonconforming use within the floodplain or floodway. Many of these requirements are set forth as factors that must be considered in determining whether a permit can be issued for certain obstructions or uses. Factors which must be considered in addressing any obstruction or use within the floodway or floodplain include:

1. the danger to life and property from backwater or diverted flow caused by the obstruction or use;
2. the danger that the obstruction or use will be swept downstream to the injury of others;
3. the availability of alternate locations;
4. the construction or alteration of the obstruction or use in such a manner as to lessen the danger;
5. the permanence of the obstruction or use; and
6. the anticipated development in the foreseeable future of the area which may be affected by the obstruction or use.

<u>See</u> § 76-5-406, MCA; ARM 36.15.216 (Applicable). Conditions or restrictions that generally apply to specific activities within the floodway or floodplain are:

1. the proposed activity, construction, or use cannot increase the upstream elevation of the 100-year flood a significant amount (0.5 foot or as otherwise determined by the permit-issuing authority) or significantly increase flood velocities, ARM 36.15.604 (Applicable); and
2. the proposed activity, construction, or use must be designed and constructed to minimize potential erosion.

For the substantive conditions and restrictions applicable to specific obstructions or uses, see the following applicable regulations:

Excavation of material from pits or pools - ARM 36.15.602(1).

Storage of materials must be readily removable – ARM 36.15.602(5)(b).

Water diversions or changes in place of diversion - ARM 36.15.603.

Flood control works (levees, floodwalls, and riprap must comply with specified safety standards) - ARM 36.15.606.

Roads, streets, highways and rail lines (must be designed to minimize increases in flood heights) - ARM 36.15.701(3)(c).

Structures and facilities for liquid or solid waste treatment and disposal (must be flood-proofed to ensure that no pollutants enter flood waters and may be allowed and approved only in accordance with DEQ regulations, which include certain additional prohibitions on such disposal) - ARM 36.15.701(3)(d).

Structures -ARM 36.15.702(1)(2).

Montana Natural Streambed and Land Preservation Act and Regulations, §§ 75-7-101, et seq., MCA, and ARM 36.2.401 et seq. (Applicable) - Applies if a remedial action alters or affects a streambed (including a river) or its banks. The adverse effects of any such action must be minimized. It is not anticipated that the remedial action will alter or affect a streambed or streambanks.

ARM 36.2.410 (Applicable) establishes minimum standards which would be applicable if a remedial action alters or affects a streambed, including any channel change, new diversion, riprap or other streambank protection project, jetty, new dam or reservoir or other commercial, industrial or residential development. Projects must be designed and constructed using methods that minimize adverse impacts to the stream (both upstream and downstream) and future disturbances to the stream. All disturbed areas must be managed during construction and reclaimed after construction to minimize erosion. Temporary structures used during construction must be designed to handle high flows reasonably anticipated during the construction period. Temporary structures must be completely removed from the stream channel at the conclusion of construction, and the area must be restored to a natural or stable condition. Channel alterations must be designed to retain original stream length or otherwise provide hydrologic stability. Streambank vegetation must be protected except where removal of such vegetation is necessary for the completion of the project. When removal of vegetation is necessary, it must be kept to a minimum. Riprap, rock, and other material used in a project must be of adequate size, shape, and density and must be properly placed to protect the streambank from erosion. The placement of road fill material in a stream, the placement of debris or other materials in a stream where it can erode or float into the stream, projects that permanently prevent fish migration, operation of construction equipment in a stream, and excavation of streambed gravels are prohibited unless specifically authorized by the district. Such projects must also protect the use of water for any useful or beneficial purpose. See § 75-7-102, MCA.

Section 75-7-111, MCA, (Applicable) provides that a person planning to engage in any activity that will physically alter or modify the bed or banks of a stream must give written notice to the Board of Supervisors of a Conservation District, the Directors of a Grass Conservation District, or the Board of County Commissioners if the proposed project is not within a district.

OTHER LAWS (NON-EXCLUSIVE LIST)

CECRA defines as ERCLs only applicable or relevant state and federal environmental laws. It is the responsibility of the person implementing the remedial action to comply with all other applicable laws during to remedial design, implementation, and operation and maintenance.

The following "other laws" are identified here to provide the person implementing the remedial action a reminder of other legal requirements that may apply to actions being conducted at the Bozeman Solvent Site. They do not purport to be an exhaustive list of such legal requirements, but are included because they set out related concerns that must be addressed and, in some cases, may require some advance planning. They are not included as ERCLs because they are not "environmental laws."

Other Federal Laws

Occupational Safety and Health Regulations

The federal Occupational Safety and Health Act regulations found at 29 CFR 1910 are applicable to worker protection during conduct of all remedial activities.

Other Montana Laws

1. Public Water Supply Regulations

If remedial action at the Bozeman Solvent Site requires any reconstruction or modification of any public water supply line or sewer line, the construction standards specified in ARM 17.38.101 (Applicable) must be observed.

2. Well Driller Licensing

Sections 37-43-101 to 402, MCA (applicable) provides regulations and licensing for drillers or makers of water wells and monitoring wells.

3. Water Rights

Section 85-2-101, MCA, declares that all waters within the state are the state's property, and may be appropriated for beneficial uses. The wise use of water resources is encouraged for the maximum benefit to the people and with minimum degradation of natural aquatic ecosystems.

Parts 3 and 4 of Title 85, Chapter 2, MCA, set out requirements for obtaining water rights and appropriating and utilizing water. All requirements of these parts are laws which must be complied with in any action using or affecting waters of the state. Some of the specific requirements are set forth below.

Section 85-2-301, MCA, of Montana law provides that a person may only appropriate water for a

beneficial use.

Section 85-2-302, MCA, specifies that a person may not appropriate water or commence construction of diversion, impoundment, withdrawal or distribution works therefore except by applying for and receiving a permit from the Montana Department of Natural Resources and Conservation. While the permit itself may not be required under federal law, appropriate notification and submission of an application should be performed and a permit should be applied for in order to establish a priority date in the prior appropriation system.

Section 85-2-306, MCA, specifies the conditions on which groundwater may be appropriated, and, at a minimum, requires notice of completion and appropriation within 60 days of well completion.

Section 85-2-311, MCA, specifies the criteria which must be met in order to appropriate water and includes requirements that:

1. there are unappropriated waters in the source of supply;
2 the proposed use of water is a beneficial use; and
3. the proposed use will not interfere unreasonably with other planned uses or developments.

Section 85-2-402, MCA, specifies that an appropriator may not change an appropriated right except as provided in this section with the approval of the DNRC.

Section 85-2-412, MCA, provides that, where a person has diverted all of the water of a stream by virtue of prior appropriation and there is a surplus of water, over and above what is actually and necessarily used, such surplus must be returned to the stream.

4. Controlled Ground Water Areas

Pursuant to § 85-2-507, MCA, the Montana Department of Natural Resources and Conservation has issued an Order enacting a Controlled Groundwater Area at the Bozeman Solvent Site. The requirements of the Order apply to the remedy identified in the Record of Decision.

5. Occupational Health Act, §§ 50-70-101 et seq., MCA.

ARM 17.74.101 addresses occupational noise. In accordance with this section, no worker shall be exposed to noise levels in excess of the levels specified in this regulation. This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR 1910.95 applies.

ARM 17.74.102 addresses occupational air contaminants. The purpose of this rule is to establish maximum threshold limit values for air contaminants under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse health effects. In accordance with this rule, no worker shall be exposed to air contaminant levels in excess of the threshold

limit values listed in the regulation.

This regulation is applicable only to limited categories of workers and for most workers the similar federal standard in 29 CFR 1910.1000 applies.

6. Montana Safety Act

Sections 50-71-201, 202 and 203, MCA, state that every employer must provide and maintain a safe place of employment, provide and require use of safety devices and safeguards, and ensure that operations and processes are reasonably adequate to render the place of employment safe. The employer must also do every other thing reasonably necessary to protect the life and safety of its employees. Employees are prohibited from refusing to use or interfering with the use of safety devices.

7. Employee and Community Hazardous Chemical Information

Sections 50-78-201, 202, and 204, MCA, state that each employer must post notice of employee rights, maintain at the work place a list of chemical names of each chemical in the work place, and indicate the work area where the chemical is stored or used. Employees must be informed of the chemicals at the work place and trained in the proper handling of the chemicals.

APPENDIX B

Table B-1
Cost Estimate
In Situ Enhanced Biodegradation (On-site residual source)

CAPITAL COSTS

Item	Unit	Unit Cost	Quantity	Cost	Source
Injection Points (6" nested wells - 4 intervals each to 75 feet deep)	each	$8,200	11	$90,200	Vendor/Pilot Test
Nested Monitoring Wells (6" nested wells 4 intervals each to 75 feet deep)	each	$8,200	5	$41,000	Vendor/Pilot Test
Enhanced Bioremediation Substrate	drum	$1,070	184	$196,880	Vendor/Pilot Test
Enhanced Bioremediation Substrate Injection - 11 nested wells with 4 intervals each (44) plus injection into 2 existing wells.	interval	$1,100	46	$50,600	Vendor/Pilot Test
SVE Piping (connect Zone 2 and Zone 3 extraction points, plus mobilization)	LS	$5,000	1	$5,000	Vendor/Pilot Test
Soil Vapor Monitoring Points (north of Walton Ditch)	each	$800	5	$4,000	Vendor/Pilot Test
SVE Extraction Points (north of Walton Ditch, assumes use of mobile SVE)	each	$3,200	2	$6,400	Racer
Waste Management	LS	$9,000	1	$9,000	Vendor/Pilot Test
Startup Monitoring (Baseline plus 6 Bi-weekly ground-water and field parameters)	event	$5,000	7	$35,000	See Below
			Subtotal	$438,080	
Enhanced Bioremediation Substrate (follow-up, if needed) (Costs are based on the EOS compound but other enhanced bioremediation substrates may be used.)	drum	$1,070	80	$85,600	Vendor/Pilot Test
Enhanced Bioremediation Substrate Injection (follow-up, if needed - fewer injection points than initial injection to address remaining contamination)	interval	$1,100	20	$22,000	Vendor/Pilot Test
Startup Monitoring (Baseline plus 6 Bi-weekly ground-water and field parameters)	each	$5,000	7	$35,000	See Below
			Subtotal	$142,600	
		Capital Subtotal		**$580,680**	
Construction Contingencies		25%		$145,170	10% scope, 15% bid
			Subtotal	$725,850	
Project Management		6%		$43,551	EPA Cost Guidance
Remedial Design		12%		$87,102	EPA Cost Guidance
Construction Management		8%		$58,068	EPA Cost Guidance
			Subtotal	$188,721	
		Total Capital Cost		**$914,571**	

ANNUAL OPERATION AND MAINTENANCE

Item	Unit	Unit Cost	Quantity	Cost	Source
Site Operation - includes management, communications, coordination and reporting. Also assumes operating SVE with a generator; fuel costs included.	LS	$10,000	1	$10,000	Pilot Test/Estimate
SVE Operation / Soil Gas Monitoring (Soil gas monitoring includes VOCs, H2S, O2, LEL, CH4, LEL) and emissions monitoring	week	$950	52	$49,400	Pilot Test/Estimate
Performance Monitoring (groundwater) (see below)	event	$99,525	4	$398,100	See below
Carbon Replacement w disposal (2 per year)	each	$1,200	2	$2,400	Pilot Test/Estimate
			Subtotal	$459,900	
O&M Contingencies		25%		$114,975	
		Total Annual O&M Cost		**$574,875**	

PRESENT VALUE

	Rate	3%	
	Years	**Amount**	
	5	**$3,547,330**	**Expected Alternative Implementation**
	10	$5,818,371	
	20	$9,467,259	
	30	$12,182,375	

Conceptual Monitoring Plan

Startup Monitoring

Groundwater Analytes - VOCs and biodegradation analytes (metabolic acids, nitrogen, sulfate, sulfide, dissolved gases, dissolved iron, dissolved manganese, total organic carbon, chloride, alkalinity, arsenic)		
Baseline plus 6 Biweekly ground water field parameters (water level, turbidity, temperature, SC, DO, pH, and ORP)	5	Nested Wells
	4	Intervals Per Well
Soil Vapor (TO-15)	5	Up to five existing well
	11	Soil Vapor Points - 6 existing, 5 new

Performance Monitoring (based on pilot test/estimate)

Quarterly ground-water VOCs and biodegradation analytes (metabolic acids, nitrogen, sulfate, sulfide, dissolved gases, dissolved iron, dissolved manganese, total organic carbon, chloride, alkalinity, arsenic)		
Bi-weekly soil vapor field: VOCs, H2S, O2, LEL, CH4, LEL	5	Nested Wells
Quarterly: soil vapor laboratory: VOCs (TO-15)	4	Intervals Per Well
	5	Up to five existing well
	6	Soil Vapor Points - existing

Reporting (data management)

Estimated Monitoring Costs

Biweekly startup monitoring (6)		Unit	Unit Cost	Quantity	Cost
	Equipment	event	$1,300	1	$1,300
	Labor	event	$3,700	1	$3,700
		Subtotal			$5,000

Cost Per Event - Soil Vapor		Quantity	Unit Cost	Cost
	Equipment	11	$1,300	$14,300
	Labor	11	$3,700	$40,700
	Analytical	11	$475	$5,225
		Subtotal		$60,225

Cost Per Event - Ground Water	Quantity	Unit Cost		Cost
Equipment	25	$195	per well	$4,875
Labor	25	$400	per well	$10,000
Analytical	25	$900	per well	$22,500
	Subtotal			$37,375

Annual Report				
Materials	1	$500	$500	(includes 1/4 of Report Cost)
Labor	48	$150	$7,200	
	Subtotal		$7,700	
	Total Per Event		**$99,525**	

Table B-2
Cost Estimate
Soil Vapor Extraction (Soil Vapor)

CAPITAL COSTS

Item	Unit	Unit Cost		Quantity	Cost	Source
Mobilization	each	$1,900		1	$1,900	Estimate
Extraction Wells - shallow	each	$1,050		14	$14,700	Racer
Extraction Wells - deep	each	$3,200		0	$0	Racer
Blower	each	$10,100		0	$0	Racer
Building	each	$17,900		0	$0	Racer
Piping	LS	$12,600		0	$0	Racer
Controls	LS	$5,000		0	$0	Engineer Estimate
Electrical	LS	$18,700		0	$0	Racer
Asphalt Repair	LS	$3,500		0	$0	Engineer Estimate
GAC Treatment	each	$2,700		0	$0	Racer
Waste Management	LS	$8,400		0	$0	Racer
Modular GAC	LS	$2,700		1		Racer
Startup Monitoring	event	$32,850		1	$32,850	See Below
				Subtotal	$49,450	
Construction Contingencies		25%			$12,363	10% scope, 15% bid
				Subtotal	$61,813	
Project Management		10%			$6,181	EPA Cost Guidance
Remedial Design plus Pilot Test		20% +	$15,000		$27,363	EPA Cost Guidance
Construction Management		15%			$9,272	EPA Cost Guidance
				Subtotal	$42,816	
		Total Capital Cost			**$104,628**	

ANNUAL OPERATION AND MAINTENANCE

Item	Unit	Unit Cost	Quantity	Cost	Source
Site Operation	LS	$10,000	1	$10,000	Engineer Estimate
SVE Operation	week	$900	28	$25,200	Site Cost Experience
Performance Monitoring	event	$40,550	1	$40,550	See Below
GAC Carbon Replacement	each	$1,350	1	$1,350	Replace every other year
			Subtotal	$77,100	
O&M Contingencies		25%		$19,275	
		Total Annual O&M Cost		**$96,375**	

PRESENT VALUE

	Rate	3%	
	Years	**Amount**	
	5	**$545,997**	**Expected Alternative Implementation**
	10	$926,726	
	20	$1,538,445	
	30	$1,993,621	

Conceptual Monitoring Plan

Startup Monitoring
Soil Vapor
6 points (3 outside and 3 inside BSC building)

Performance Monitoring
Annual Soil Vapor Points
6 points (3 outside and 3 inside BSC building)

Reporting (data management)

Estimated Monitoring Costs

Cost Per Event - Soil Vapor	Quantity	Unit Cost	Cost
Equipment	6	$1,300	$7,800
Labor	6	$3,700	$22,200
Analytical (TO-15)	6	$475	$2,850
		Subtotal	$32,850
Annual Report			
Materials	1	$500	$500
Labor	48	$150	$7,200
		Subtotal	$7,700
		Total Per Event	**$40,550**

Table B-3
Cost Estimate
New or Deeper Replacement Drinking Water Wells (altenrate drinking water north of East Gallatin River)

CAPITAL COSTS

Item	Unit	Unit Cost		Quantity	Cost	Source
Mobilization	LS	$2,800		1	$2,800	Racer
Domestic Well (200' deep, upper aquifer seal)	each	$16,000		5	$80,000	Vendor
Pump (25 to 30 gpm)	each	$600		5	$3,000	Vendor
Service Line Connections	each	$2,000		5	$10,000	Engineer Estimate
Startup Monitoring	well	$4,000		5	$20,000	See Below
				Subtotal	$115,800	
Construction Contingencies		25%			$28,950	10% scope, 15% bid
				Subtotal	$144,750	
Project Management		8%			$11,580	EPA Cost Guidance
Remedial Design		15% +	$0		$21,713	EPA Cost Guidance
Construction Management plus Well Logging		10%	$16,000		$30,475	EPA Cost Guidance
				Subtotal	$63,768	
		Total Capital Cost			**$208,518**	

ANNUAL OPERATION AND MAINTENANCE (1 to 5 years)

Item	Unit	Unit Cost	Quantity	Cost	Source
Performance Monitoring	each	$4,000	2	$8,000	See below
			Subtotal	$8,000	
O&M Contingencies		25%		$2,000	
		Total Annual O&M Cost		**$10,000**	

ANNUAL OPERATION AND MAINTENANCE 6 to 30 years)

Performance Monitoring	each	$4,000	1	$4,000	See Below
			Subtotal	$4,000	
O&M Contingencies		25%		$1,000	
		Total Annual O&M Cost		$5,000	

PRESENT VALUE

	Rate	3%	
	Years	**Amount**	
	5	$254,315	
	10	$274,067	
	20	$330,803	
	30	**$329,418**	**Expected Alternative Implementation**

Conceptual Monitoring Plan

Startup Monitoring
Groundwater VOCs (Method 524.2)
Groundwater Domestic Well Analytes (see below list)

Performance Monitoring -Semi-annual
Groundwater VOCs
Groundwater Domestic Well Analytes

Estimated Monitoring Costs

Cost Per Well per Event - Groundwater	Quantity	Unit Cost		Cost
Equipment	5	$150	per well	$750
Labor	5	$400	per well	$2,000
Analytical	5	$250	per well	$1,250
	Subtotal			$4,000

Table B-4
Cost Estimate
Monitored Natural Attenuation (Off-site dissolved groundwater plume)

CAPITAL COSTS

Item	Unit	Unit Cost		Quantity	Cost	Source
Monitoring Wells (nested, 2 intervals)	LS	$9,700		4	$38,800	Racer
Startup Monitoring	Event	$5,760		1	$5,760	See Below
				Subtotal	$44,560	
Construction Contingencies		25%			$11,140	10% scope, 15% bid
				Subtotal	$55,700	
Project Management		10%			$5,570	EPA Cost Guidance
Remedial Design plus easements		20% +	$10,000		$21,140	EPA Cost Guidance
Construction Management plus well logging		15% +	$10,000		$18,355	EPA Cost Guidance
				Subtotal	$45,065	
		Total Capital Cost			**$100,765**	

ANNUAL OPERATION AND MAINTENANCE (Years 1 to 5)

Item	Unit	Unit Cost	Quantity	Cost	Source
Site Operations - includes communications, coordination, and reporting, etc.	LS	$25,000	1	$25,000	Racer
Performance Monitoring	event	$8,850	2	$17,700	See Below
			Subtotal	$42,700	
O&M Contingencies		25%		$10,675	
		Total Annual O&M Cost		**$53,375**	

ANNUAL OPERATION AND MAINTENANCE (Years 6 to 30)

Item	Unit	Unit Cost	Quantity	Cost	Source
Site Operations	LS	$15,000	1	$15,000	Racer
Performance Monitoring	event	$8,850	1	$8,850	See Below
			Subtotal	$23,850	
O&M Contingencies		25%		$5,963	
		Total Annual O&M Cost		**$29,813**	

PRESENT VALUE **Rate** 3%

Years	Amount	
5	$345,207	
10	$462,981	
20	$652,209	
30	**$793,013**	**Expected Alternative Implementation**

Conceptual Monitoring Plan

Performance Monitoring
Semi-annual Groundwater VOCs (Method 8260 or 52.4.2)
4 nested wells (8 intervals)

Reporting (data management)

Estimated Monitoring Costs

Cost Per Event - Groundwater (First 5 Years)	Quantity	Unit Cost		Cost
Equipment	8	$150	per well	$1,200
Labor	8	$350	per well	$2,800
Analytical	8	$125	per well	$1,000
	Subtotal			$5,000
Annual Report				
Materials	1	$500		$500
Labor	48	$150		$7,200
	Subtotal			$7,700
	Total Per Event			**$8,850** (includes 1/2 of Report Cost)

Table B-5
Cost Estimate
Institutional Controls

CAPITAL COSTS

Item	Unit	Unit Cost	Quantity	Cost	Source
Zoning/Restrictive Covenants	LS	$2,500	1	$2,500	DEQ Estimate
			Subtotal	$2,500	
Trench Construction Permitting System	Legal			$1,500	City Estimate
	Technical			$350	City Estimate
	City Staff			$1,000	City Estimate
	Expenses			$100	City Estimate
			Subtotal	$2,950	
		Capital Subtotal		$5,450	
Contingencies		25%		$1,363	
		Total Capital Cost		**$6,813**	

Table B-6
Cost Estimate
Connection to City Water - Administrative Areas A and B (South of East Gallatin River)

CAPITAL COSTS

Item	Unit	Unit Cost	Quantity	Cost	Source
Water Main Tap and Service Stub	Each	$2,000	2	$4,000	City / Engineer Estimate
Service Connections	Each	$5,000	10	$50,000	City / Engineer Estimate
			Subtotal	$54,000	
Construction Contingencies		25%		$13,500	10% scope, 15% bid
			Subtotal	$67,500	
Project Management		10%		$6,750	EPA Cost Guidance
Remedial Design		20%		$13,500	EPA Cost Guidance
Construction Management		15%		$10,125	EPA Cost Guidance
			Subtotal	$30,375	
		Total Capital Cost		**$97,875**	

ANNUAL OPERATION AND MAINTENANCE

Item	Unit	Unit Cost	Quantity	Cost	Source
City O&M	each	$1,000	1	$1,000	Estimate
			Subtotal	$1,000	
O&M Contingencies		25%		$250	
		Total Annual O&M Cost		**$1,250**	

PRESENT VALUE **Rate** 3%

Years	**Amount**
5	$103,600
10	$108,538
20	$116,472
25	$119,641
27	$120,784
30	**$122,376**

Expected Alternative Implementation (Predicted No Action cleanup time of 27 years round up to 30 years.)

Table B-7
Cost Estimate
Long-Term Monitoring

Conceptual Long-Term Monitoring Plan
(changes from semi-annual to annual after 5 years)
Monitoring Plan

Wells	28	(42 wells sampled per year - 28 in summer; 14 in winter)
Analytes (VOCs - Method 8260 or 524.2)		
Frequency	2	Semi-Annual (more wells in June than December)
Report	1	Annual Report

Estimated Monitoring Costs

Years 1-5

Cost Per Year - Ground Water	Quantity	Unit Cost		Cost
Equipment	42	$150	per well	$6,300
Labor	42	$350	per well	$14,700
Analytical (VOCs - Method 8260 or 52.4.2)	42	$150	per well	$6,300
		Subtotal		**$27,300**
Project Management				
Materials	1	$500		$500
Labor	48	$150		$7,200
		Subtotal		**$7,700**
		Subtotal		**$35,000**

Years 6 - 30

Cost Per Year - Ground Water	Quantity	Unit Cost		Cost
Equipment	28	$150	per well	$4,200
Labor	28	$350	per well	$9,800
Analytical	28	$150	per well	$4,200
		Subtotal		**$18,200**
Project Management				
Materials	1	$500		$500
Labor	40	$150		$6,000
		Subtotal		**$6,500**
		Subtotal		**$24,700**

PRESENT VALUE **Rate** 3%

Years	**Amount**	
5	$160,290	
10	$257,867	
20	$414,645	
30	**$531,302**	**Expected Alternative Implementation**

APPENDIX C

(Lot 1)
DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY

THIS DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY (Restrictive Covenants) is made by [insert owner's name] as of [insert date].

RECITALS

WHEREAS, [insert owner's name] is the owner of certain real property (the Subject Property) located in Gallatin County, Montana, is shown on Attachment 1 and is more particularly described as:

[insert property description]

WHEREAS, the Subject Property is located within the Bozeman Solvent Site (Facility) upon which hazardous or deleterious substances have come to be located;

WHEREAS, the Montana Department of Environmental Quality (DEQ) has determined that releases or threatened releases of hazardous or deleterious substances that may pose an imminent or substantial endangerment to public health, safety or welfare or the environment exist and that these hazardous or deleterious substances have come to be located upon the Subject Property;

WHEREAS, DEQ, under the authority of the Montana Comprehensive Environmental Cleanup and Responsibility Act, §§ 75-10-701 et seq., MCA, has issued a Record of Decision for the Facility and selected a remedy to abate the imminent and substantial endangerment posed by the hazardous or deleterious substances;

WHEREAS, DEQ has determined that the City of Bozeman and CVS Pharmacy, Inc. (Liable Parties) are responsible for implementing the Record of Decision;

WHEREAS, the selected remedy requires that (insert name of property owner) restrict use of the Subject Property in order to mitigate the risk to the public health, safety or welfare or the environment and DEQ requires that such restrictions be recorded as provided for in § 75-10-727, MCA:

NOW, THEREFORE, [insert owner's name] hereby agrees and declares:

1. No residential development or use, including but not limited to permanent residential use; temporary residential use; limited residential use; short-term residential use; children's day care; mobile homes with or without footings; mobile home with or without a pad; or camping shall occur upon the Subject Property. It is the [insert owner's name] intent that this limitation be construed as broadly as possible to prohibit any type of residential use whatsoever.

2. No action shall be taken, allowed, suffered, or omitted on the Subject Property if such action or omission is reasonably likely to create a risk of migration of hazardous or deleterious substances or a potential hazard to public health, safety, or welfare or the environment or result in a disturbance of the structural integrity of any engineering controls designed or utilized at the Facility to contain hazardous or deleterious substances or limit human or environmental exposure to the hazardous or deleterious substances.

3. [Insert owner's name] agrees to provide DEQ and its representatives and contractors and all representatives and contractors of any person, including the Liable Parties, conducting DEQ-approved remedial actions on the Subject Property access at all reasonable times to the Subject Property.

4. At all times after [insert owner's name] conveys its interest in the Subject Property and no matter what person or entity is in title to or in possession of the Subject Property, [insert owner's name] agrees that DEQ, the Liable Parties, and their representatives shall retain the right to enter the Subject Property at reasonable intervals and at reasonable times of the day in order to inspect for violations of the Restrictive Covenants contained herein.

5. DEQ shall be entitled to enforce these Restrictive Covenants as an intended beneficiary thereof. [Insert owner's name] specifically agrees that the remedy of "specific performance" of these Restrictive Covenants shall be available to DEQ in such proceedings. Venue for enforcement of these Restrictive Covenants by DEQ shall be in the state First Judicial District Court, Montana.

6. The Liable Parties are also entitled to enforce these Restrictive Covenants as intended beneficiaries thereof. [Insert owner's name] specifically agrees that the remedy of "specific performance" of these Restrictive Covenants shall be available to the Liable Parties in such proceedings. Venue for enforcement of these Restrictive Covenants by the Liable Parties shall be in the state Eighteenth Judicial District Court, Montana.

7. The provisions of these Restrictive Covenants of the Subject Property shall run with the land and bind all holders, owners, lessees, occupiers, and purchasers of the Subject Property. These restrictive covenants apply in perpetuity and every subsequent instrument conveying an interest in all or any portion of the Subject Property shall include these Restrictive Covenants. [Insert owner's name] will notify DEQ of any proposed conveyance of all or a portion of the Subject Property at least 30 days prior to any such conveyance. [Insert owner's name] and all future owners will provide notice to all potential purchasers by providing a copy of these Restrictive Covenants prior to the conveyance of all or a portion of the Subject Property and shall provide a copy of this notice to DEQ.

8. [Insert owner's name] and all future owners shall cause the requirements of these Restrictive Covenants to be placed in all instruments that convey an interest in the Subject Property and shall file this document with the county clerk and recorder in Gallatin County, Montana.

9. The rights provided to DEQ in this Declaration include any successor agencies of DEQ.

10. As provided for in § 75-10-727, MCA, these restrictive covenants may only be removed with the advance written approval of DEQ.

IN WITNESS WHEREOF, [insert owner's name] has executed this Declaration of Restrictive Covenants on Real Property as of the first date written above.

[INSERT OWNER'S NAME]

____
By:

State of Montana)
:ss.
County of [insert county name])

On this __ day of ________, 20__, personally appeared ________________, before me, a Notary Public for the State of Montana, known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same.

IN WITNESS WHEREOF I have hereunto set my hand and affixed my official seal the day and year hereinabove first written.

____
NOTARY PUBLIC FOR THE STATE OF MONTANA
(SEAL) Residing at ____________________________________
My Commission Expires: ________________________

(Lot 2)
DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY

THIS DECLARATION OF RESTRICTIVE COVENANTS ON REAL PROPERTY (Restrictive Covenants) is made by [insert owner's name] as of [insert date].

RECITALS

WHEREAS, [insert owner's name] is the owner of certain real property (the Subject Property) located in Gallatin County, Montana, is shown on Attachment 1 and is more particularly described as:

[insert property description]

WHEREAS, the northwest corner of that property has been surveyed (the Surveyed Portion of the Subject Property) and is more particularly described as:

[insert surveyed property description]

WHEREAS, the Subject Property is located within the Bozeman Solvent Site (Facility) upon which hazardous or deleterious substances have come to be located;

WHEREAS, the Montana Department of Environmental Quality (DEQ) has determined that releases or threatened releases of hazardous or deleterious substances that may pose an imminent or substantial endangerment to public health, safety or welfare or the environment exist and that these hazardous or deleterious substances have come to be located upon the Surveyed Portion of the Subject Property;

WHEREAS, DEQ, under the authority of the Montana Comprehensive Environmental Cleanup and Responsibility Act, §§ 75-10-701 et seq., MCA, has issued a Record of Decision for the Facility and selected a remedy to abate the imminent and substantial endangerment posed by the hazardous or deleterious substances;

WHEREAS, DEQ has determined that the City of Bozeman and CVS Pharmacy, Inc. (Liable Parties) are responsible for implementing the Record of Decision;

WHEREAS, the selected remedy requires that (insert name of property owner) restrict use of the Surveyed Portion of the Subject Property in order to mitigate the risk to the public health, safety or welfare or the environment and DEQ requires that such restrictions be recorded as provided for in § 75-10-727, MCA:

NOW, THEREFORE, [insert owner's name] hereby agrees and declares:

1. No residential development or use, including but not limited to permanent residential use; temporary residential use; limited residential use; short-term residential use; children's day care; mobile homes with or without footings; mobile home with or without a pad; or

camping shall occur upon the Surveyed Portion of the Subject Property. It is the [insert owner's name] intent that this limitation be construed as broadly as possible to prohibit any type of residential use whatsoever.

2. No action shall be taken, allowed, suffered, or omitted on the Subject Property if such action or omission is reasonably likely to create a risk of migration of hazardous or deleterious substances or a potential hazard to public health, safety, or welfare or the environment or result in a disturbance of the structural integrity of any engineering controls designed or utilized at the Facility to contain hazardous or deleterious substances or limit human or environmental exposure to the hazardous or deleterious substances.

3. No construction or development of any kind may occur on the Surveyed Portion of the Subject Property during the time that the residual source area is undergoing active treatment (enhanced bioremediation) provided for in the Record of Decision. This prohibition on construction and development is limited to the time of active treatment; once DEQ determines the active treatment is complete, this restriction can be removed as provided for in (11) below.

4. [Insert owner's name] agrees to provide DEQ and its representatives and contractors and all representatives and contractors of any person, including the Liable Parties, conducting DEQ-approved remedial actions on the Subject Property access at all reasonable times to the Subject Property.

5. At all times after [insert owner's name] conveys its interest in the Subject Property and no matter what person or entity is in title to or in possession of the Subject Property, [insert owner's name] agrees that DEQ, the Liable Parties, and their representatives shall retain the right to enter the Subject Property at reasonable intervals and at reasonable times of the day in order to inspect for violations of the Restrictive Covenants contained herein.

6. DEQ shall be entitled to enforce these Restrictive Covenants as an intended beneficiary thereof. [Insert owner's name] specifically agrees that the remedy of "specific performance" of these Restrictive Covenants shall be available to DEQ in such proceedings. Venue for enforcement of these Restrictive Covenants by DEQ shall be in the state First Judicial District Court, Montana.

7. The Liable Parties are also entitled to enforce these Restrictive Covenants as intended beneficiaries thereof. [Insert owner's name] specifically agrees that the remedy of "specific performance" of these Restrictive Covenants shall be available to the Liable Parties in such proceedings. Venue for enforcement of these Restrictive Covenants by the Liable Parties shall be in the state Eighteenth Judicial District Court, Montana.

8. The provisions of these Restrictive Covenants of the Subject Property shall run with the land and bind all holders, owners, lessees, occupiers, and purchasers of the Subject Property. These restrictive covenants apply in perpetuity and every subsequent instrument conveying an interest in all or any portion of the Subject Property shall

include these Restrictive Covenants. [Insert owner's name] will notify DEQ of any proposed conveyance of all or a portion of the Subject Property at least 30 days prior to any such conveyance. [Insert owner's name] and all future owners will provide notice to all potential purchasers by providing a copy of these Restrictive Covenants prior to the conveyance of all or a portion of the Subject Property and shall provide a copy of this notice to DEQ.

9. [Insert owner's name] and all future owners shall cause the requirements of these Restrictive Covenants to be placed in all instruments that convey an interest in the Subject Property and shall file this document with the county clerk and recorder in Gallatin County, Montana.

10. The rights provided to DEQ in this Declaration include any successor agencies of DEQ.

11. As provided for in § 75-10-727, MCA, these restrictive covenants, or a portion thereof, may only be removed with the advance written approval of DEQ.

IN WITNESS WHEREOF, [insert owner's name] has executed this Declaration of Restrictive Covenants on Real Property as of the first date written above.

[INSERT OWNER'S NAME]

____
By:

State of Montana)
:ss.
County of [insert county name])

On this __ day of ________, 20__, personally appeared ________________, before me, a Notary Public for the State of Montana, known to me to be the person whose name is subscribed to the within instrument and acknowledged to me that he executed the same.

IN WITNESS WHEREOF I have hereunto set my hand and affixed my official seal the day and year hereinabove first written.

____
NOTARY PUBLIC FOR THE STATE OF MONTANA
(SEAL) Residing at ____________________________________
My Commission Expires: _________________________

PART 3

RESPONSIVENESS SUMMARY

TABLE OF CONTENTS

1.0 INTRODUCTION

The Montana Department of Environmental Quality (DEQ) solicited public comment on the February 2011 Final Draft Feasibility Study (FS) Report (NE&W, 2011a) and the Proposed Plan (DEQ, 2011b) for the Bozeman Solvent Site (BSS) facility in Bozeman, Montana, during a public comment period that ran from February 28, 2011 through March 29, 2011. DEQ also held a public meeting and hearing in Bozeman on March 9, 2011. DEQ received oral comments from three organizations at the public hearing, and received written comments from a number of individuals or organizations during the public comment period, one of whom had also provided oral comments (DEQ, 2011h).

1.1 Community Involvement Background

The Montana Comprehensive Environmental Cleanup and Responsibility Act (CECRA) provides for the public to have input into the DEQ decision-making process with respect to the final cleanup of state Superfund facilities. At the BSS, DEQ has made a concerted effort to involve the community, including local officials and residents, in all aspects of the investigation and cleanup. DEQ has conducted more outreach and opportunity for public comment than is required by CECRA. For example, DEQ sought public comment on the Draft Final Phase Remedial Investigation (RI) Work Plan (RIWP), the Draft Final Phase RI Report, the final draft Feasibility Study Work Plan (final draft FSWP), and the draft final Baseline Risk Assessment Work Plan (draft final BRWAP). DEQ held public meetings to discuss the RIWP, prepared a written responsiveness summary, and made changes to the RI based on public comment. DEQ also sought public comment on the FS and Proposed Plan, prepared this written responsiveness summary, and made changes, if necessary, to the FS and the ROD based on public comment.

1.1.1 Notification of Public Comment Period

Press releases were sent to newspapers, television stations, and radio stations to announce public comment periods for the FS and Proposed Plan. Public meetings were also announced in the local newspaper and occasionally on the local television or radio stations. Printed notices were published in the Bozeman Daily Chronicle, a daily newspaper, and on DEQ's website. DEQ sent notice of the public comment period and meeting to the approximately 267 people on its mailing list for the BSS. DEQ sent letters regarding the opportunity for public comment to the Bozeman City Commission, the Gallatin County Commissioners, the Gallatin City-County Health Department, the Gallatin Local Water Quality District, RMRG Portfolio, LLC., and the liable persons, the City of Bozeman (City) and CVS Pharmacy, Inc. (CVS). DEQ also posted the documents and notice of the public comment period and public meeting on its website.

1.1.2 Administrative Record

The administrative record is the set of documents DEQ cited, relied upon, or considered when determining the final remedy. References to the administrative record are found in Part 2, Section 14.0 of the Record of Decision (ROD). The complete files for the BSS, including the documents making up the administrative record for the ROD, are available for public review at the DEQ offices in Helena. A partial compilation of files, including major documents related to the facility, is available for public review at the Bozeman City Library in Bozeman, and on DEQ's website at http://deq.mt.gov/statesuperfund/bozeman_solvent.mcpx.

1.1.3 Document Repositories

The administrative record contains the documents cited, relied upon, or considered in selecting the final remedy for the BSS, and is provided in Part 2, Section 14.0 of the ROD. It does not include legal citations such as those found in the Montana Code Annotated (MCA), Administrative Rules of Montana (ARM), United States Code, and Code of Federal Regulations. Any document, model, or other reference identified in the Final RI Report (NE&W, 1999b), Baseline Human Health Risk Assessment and addendums (DEQ, 2010c, 2010d, and 2011a), and Final FS Report (NE&W, 2011d) are also incorporated herein as part of the administrative record.

The complete administrative record is located at:

Montana Department of Environmental Quality
Remediation Division
Hazardous Waste Site Cleanup Bureau
1100 North Last Chance Gulch
Helena, MT 59601
Telephone: (406) 841-5000

A partial compilation of the administrative record can be found on DEQ's website at http://deq.mt.gov/statesuperfund/bozeman_solvent.mcpx and at:

Bozeman City Library
626 E. Main St.
Bozeman, MT 59715
Telephone: 406-582-2406

1.1.4 Updates

To keep citizens updated about site activities during the RI/FS, DEQ published informational mailings. These reports contained information on recently released documents, upcoming activities and meetings, completion of activities, sampling results and other information. Informational updates were sent to individuals on the mailing list for the BSS and local media, as well as to city and county officials, and liable persons. Informational updates will continue during remedial design and implementation, and will be available on DEQ's website listed above.

1.1.5 Toll-free Hotline

DEQ maintains an in-state toll-free number (1-800-246-8198) for people who want to contact DEQ about the BSS or other Superfund facilities. DEQ Remediation Division staff members direct calls to appropriate project officers. The toll-free number is answered in person during business hours. In addition, DEQ maintains a website at http://deq.mt.gov.

1.1.6 Mailing List

DEQ maintains a mailing list that is periodically updated. DEQ has actively solicited additions to the mailing list in informational updates and at public meetings. In accordance with state law, the mailing list is generally not released to the public.

1.2 Explanation of Responsiveness Summary

All comments received during the public comment period on the FS and Proposed Plan have been reviewed and considered by DEQ in the decision making process and are addressed in this Responsiveness Summary. To assist in developing responses, DEQ added its own numbering to comments where appropriate to add clarity. Each specific oral and written comment is stated verbatim. In order to avoid duplication of some responses, similar comments are usually addressed only once for the first occurrence of the comment and thereafter referenced to the appropriate response. Written comments on the Proposed Plan and FS and the transcript from the March 9, 2011 public hearing are part of the administrative record and are referenced in Part 2, Section 14.0 of the ROD (DEQ, 2011h and 2011o). In addition, all other documents cited in DEQ's responses are part of the administrative record and are also referenced in Part 2, Section 14.0 of the ROD.

2.0 RESPONSES TO ORAL COMMENTS

2.1 Comments from Erinn Zindt, representing the Gallatin Local Water Quality District

For the record, I'm Erinn Zindt. I'm with a Water Quality Specialist for the Gallatin Local Water Quality District. Alan English, our District Manager, had a scheduling conflict so he couldn't be here tonight. He requested that I just pass on a few comments. So excuse me if I read. The Gallatin Local Water Quality District has been monitoring remediation and groundwater monitoring activities for the Bozeman Solvent Site for many years. We're pleased to see that the level of effort that's been put forth in the past few years by the responsible parties and DEQ to move forward with the clean, the cleanup of this site. Completion of the Feasibility Study and the development of the Proposed Plan for site cleanup are both significant milestones, and the Gallatin Local Water Quality District commends the City, CVS and DEQ for these efforts. Recent completion of other work at the site, including the bioremediation pilot test, are also significant efforts that have moved the site forward towards final cleanup. The District also commends the City and CVS for this effort. The District is currently reviewing the Feasibility Study and Proposed Plan, along with other documents, and will provide written comments to DEQ regarding the Proposed Plan. Based on our initial review of the Proposed Plan, we tentatively support it as drafted. Any specific questions or concerns will be addressed in a letter to DEQ prior to the deadline for the public comment.

Response: Comment noted.

2.2 Comments from Chris Kukulski, representing the City of Bozeman

For the record, Chris Kukulski, Bozeman City Manager, 121 North Rouse is the address of City Hall; so first of all I just want to express the City and CVS's appreciation for the recent progress that has been made and we've all worked for many, many years on this project, so to get to this point where we can be focused moving forward on, on remediation I think is what all of us see in our best interest. We're grateful too for the momentum that's been gained to Director Opper, Kate Fry, Denise, and, and Cindy Brooks for their work and uh getting us to this point, and we just look forward to remediating it now. It's been a long time, a lot of time has been spent, and a lot of money has been spent studying and analyzing, and we're anxious to spend resources actually remediating it. So thank you to the DEQ.

Response: Comment noted.

2.3 Comments from Tim Roark, representing the Gallatin City County Health Department

For the record, I'm Tim Roark, Environmental Health Director for the Gallatin City-County Health Department. I do want to just echo what the two previous speakers have said. Congratulate the PRPs and DEQ for making these steps. To paraphrase terminolgist to Neil Armstrong - a small step on this small step here's a great step for this project, and I congratulate them for doing that. And, the Gallatin City-County Health Department looks forward to working with the City and the PRPs and DEQ and any assistance we can to make this go forward. Thank you.

Response: Comment noted.

3.0 RESPONSES TO WRITTEN COMMENTS

3.1 Comments from Esther Nelson, Nelson's Mobile Home Park

Thank you for the in-depth proposed plan for cleanup activities at the Bozeman Solvent Site Facility which was reviewed at the meeting held in Bozeman March 9.

From my perspective the Plan identifies and explains DEQ's preferred alternative for addressing this imminent and substantial endangerment of PCE and other hazardous or deleterious substances into the environment that presents endangerment to the public health, safety or welfare or the environment from the Bozeman Solvent Site located in the City of Bozeman and effecting residences and commercial facilities through public water and private water wells, such contamination extending from the Buttrey's Shopping Center to the north side of the East Gallatin River, approximately 2.5 miles.

Those of us who have been directly affected appreciate the effort and expertise of DEQ with the assistance of the City and CVS in preparing the baseline human risk assessment for the BSS and the document finalized in 2010.

Response: Comment noted.

3.2 Comments from Harry P. Mann

I live at 100 Gibson Drive - on the west bank of the East Gallatin River. My domestic well for household and gardening use is downstream of the plume (south of the river as described in the March 11 Bulletin).

The well has been monitored yearly since about 1998 (with no detectible contaminants) as part of the remediation program. Am I correct in assuming this monitoring is the crux of the Monitored Natural Attenuation (MNA) proposed in Alternative 14?

I don't see an alternative in the proposed, preferred, cleanup plan that specifically addresses <u>non</u>-contaminated drinking water wells-either north or <u>south of the river</u>. Or is Alternative 14 the intended process for those installations?

I would propose that the situations I note above re <u>all</u> <u>non-</u>contaminated drinking water wells and those south of the river be addressed in the Proposed Cleanup Plan.

<u>Response</u>: The historic groundwater monitoring was one of the criteria evaluated to select monitored natural attenuation (MNA) as the remedy cleanup the off-site groundwater plume portion of the BSS. Natural attenuation processes are typically occurring at all sites, but to varying degrees of effectiveness depending upon the types and concentrations of contaminants present and the physical, chemical and biological characteristics of soil and groundwater (EPA, 1999a; EPA, 2004a; and ITRC, 2007d). DEQ uses a "lines of evidence" approach to evaluate if MNA will be an effective remedial alternative, including a consideration of 1) historical groundwater and/or soil chemistry data that demonstrate a clear and meaningful trend of decreasing contaminant mass and/or concentrations over time at appropriate monitoring or sampling points; and 2) hydrogeologic and geochemical data that can be used to demonstrate indirectly the types(s) of natural attenuation processes active at the site and the rate at which such processes will reduce contaminant concentrations to required levels (EPA, 1999a; EPA, 2004a; and ITRC, 2007d).

Over 80 wells have been sampled as part of the BSS since 1989. Many of these wells have been sampled annually to semi-annually for more than 10 years. This historic groundwater sampling data has established concentration trends of PCE. These trends show an overall drop or decrease in PCE concentrations, especially following interim remedial actions (e.g. soil vapor extraction [SVE] and contaminated soil removal) conducted in the source area in the 1990s (ATC, 2011b). The regional fate and transport model (F&T model) conducted for the BSS shows a continued decreasing trend in most groundwater wells at the BSS. For those few wells that show increasing trends, the F&T model predicts that PCE concentrations will peak within the next five years and then begin to decrease (NE&W, 2011d).

Both the established groundwater trends and the predicted groundwater trends are based on historic groundwater data and demonstrate that MNA is an effective and reliable remedial action at the BSS. DEQ will consider MNA in conjunction with other remediation measures that address the contaminant source as outlined in EPA's MNA guidance (EPA, 1999a). The ROD identifies enhanced bioremediation of the residual source area to address the remaining contaminant.

A remedy to directly address non-contaminated drinking water wells was not selected because non-contaminated drinking water wells do not pose an unacceptable risk to human health and can continue to be used for human consumption. This includes wells on the south side and north side of the East Gallatin River. However, the ROD does identify remedies to protect existing non-contaminated drinking water wells should they become contaminated at levels that pose an unacceptable risk to human health. In addition, the selected remedy partially relies on institutional controls in the form of the existing Controlled Groundwater Area (CGWA) Order (DNRC, 1998) to protect human health and limit migration of contaminants through pumping. The existing CGWA Order ensures that the installation of future wells is limited, that new wells will not induce or redirect contaminated groundwater, and that no drinking water wells are installed within or adjacent to the BSS contamination where City water services exist. While there are domestic and commercial/industrial use wells currently in operation in the vicinity of the BSS, the City supplies public water to the majority of homes and businesses in the area. Therefore, the impact of prohibition of additional wells is limited since an additional source of water is available.

The long-term groundwater monitoring program will protect non-contaminated wells by confirming the effectiveness of the remedial actions, including MNA, and ensuring people are not exposed to contaminants of concern (COCs) above the U.S. Environmental Protection Agency (EPA) maximum contaminant level (MCL)/Montana Numeric Water Quality Standards (DEQ-7). If the long-term monitoring shows COC concentrations exceed the MCL/DEQ-7 standard in a drinking water well, that residence or business will be connected to City water (south side) or to new or deeper replacement drinking water wells (north side). In addition, the existing CGWA will remain in place until MCL/DEQ-7 standards are met. This will ensure that new drinking water wells are not installed in areas of contamination if City water is available and will limit the number of wells installed so groundwater pumping will not cause contaminated groundwater to move into uncontaminated areas.

3.3 Comments from Alan English, Gallatin Local Water Quality District

I have reviewed the <u>Final Draft Feasibility Study Report Bozeman Solvent Site,</u> prepared by Nicklin Earth & Water, Inc., and the <u>Proposed Plan-Proposed Cleanup Alternative for the Bozeman Solvent Site</u> prepared by the Montana Department of Environmental Quality (DEQ). In addition, several other documents referenced in the Proposed Plan were also reviewed. Based on this review, the Gallatin Local Water Quality District concurs with, and supports the Proposed Plan as drafted, and provides the following comments for the record.

1) *The selection of enhanced bioremediation as the technology to address the remaining residual PCE source on-site makes sense, as this technology has been successfully tested at the site. I do have some concern with off-site migration of vinyl chloride using this method, and recommend that DEQ make sure that down-gradient ground water monitoring wells provide sufficient coverage to verify that the vinyl chloride does get oxidized before reaching any possible down-gradient receptors.*

2) *The proposed use of soil vapor extraction (SVE) to address on-site soil and sub-slab vapors is a much better alternative than passive soil venting. The proposed SVE system has two advantages over passive soil venting. First, the vapors produced will be removed from the air prior to discharge to the atmosphere, and second, the SVE system will also aid in removal of any remaining residual PCE in the subsurface soils that may not have been identified.*

3) *While I am not as supportive of monitored natural attenuation to address the off-site dissolved PCE plume, other options are unreasonably expensive, and may not be that effective.*

Overall, the Gallatin Local Water Quality District is pleased to see the level of progress that has occurred at the site in the last few years and supports the actions of DEQ, the City of Bozeman, and CVS. I encourage all of the parties to work together to keep remediation of this site on a fast track. I recommend that the Record of Decision and the Remedial Design be completed as soon as possible, so that remedial actions at the site can be started this field season, if possible. If you have any questions, please call 582-3148.

<u>Response</u>: The City and CVS have committed to DEQ that they will implement the final remedy identified in the ROD and DEQ expects that portions of the final remedy will be implemented in 2011. Responses to specific points are provided below:

1) DEQ agrees that careful monitoring of the downgradient wells is necessary as part of implementation of the enhanced bioremediation. Four off-site nested monitoring well pairs were included in the enhanced bioremediation alternative conceptual design to monitor vinyl chloride. DEQ will further evaluate the placement of these wells during remedial design and require these or additional wells, as appropriate, to monitor the potential off-site migration of vinyl chloride in the groundwater. In addition, three existing monitoring wells, including a nested well pair, are downgradient of the former Buttrey's Shopping Center (BSC). These wells are currently monitored annually to semi-annually and will likely be included in the performance monitoring for the enhanced bioremediation portion of the remedy and/or the long-term monitoring.

During implementation of the selected remedy of enhanced bioremediation, vinyl chloride will likely be generated and increases in concentrations exceeding the DEQ-7 standard (0.2 μg/L) downgradient of the treatment area are likely to be observed. The ROD requires that injection rates and substrate concentrations be evaluated during remedial design to minimize the vinyl chloride generation in off-site groundwater. Based on this comment, DEQ has specifically identified that if performance monitoring indicates that vinyl chloride is not oxidizing at a rate that will prevent receptors (i.e., drinking water wells) from being exposed to unacceptable levels of contamination, DEQ will require additional remedial measures, such as air sparging, to protect human health. The FS identified air sparging as a remedy that is effective on chlorinated solvents and meets CECRA criteria. Air sparging was not selected as the primary remedy, but can be used as a polishing tool to address vinyl chloride concentrations in groundwater downgradient of the enhanced bioremediation treatment area if receptors are threatened. Costs associated with an active remedy, such as air sparging, to address vinyl chloride in groundwater downgradient of the enhanced bioremediation treatment were not included in the cost estimates. However, the FS described air sparging (Alternative 4), and provided costs (NE&W, 2011d).

In addition, the conceptual design of the enhanced bioremediation portion of the remedy included five off-site soil vapor probes to monitor soil vapor downgradient of the treatment area. DEQ will further evaluate the placement of these soil vapor probes during remedial design and require these or additional probes, as appropriate, to monitor the potential off-site migration of vinyl chloride in the soil vapor. If monitoring shows soil vapor concentrations above trigger concentrations identified in the ROD, DEQ will require installation and operation of an off-site SVE system until soil vapor concentrations are below the trigger concentrations to ensure protection of receptors (i.e. indoor air in off-site structures). The placement and monitoring of the soil vapor probes and design of an off-site SVE system, if needed, will be included in the remedial design.

2) Comment noted.

3) DEQ agrees that, based on the site-specific evaluation of alternatives for the off-site dissolved groundwater plume identified in the FS (NE&W, 2011d), MNA is the preferred remedy.

3.4 Comments from Carrie R. Wasserburger, Wittich Law Firm

Our firm has been retained by Red Mountain Retail Group, Inc. (hereinafter "RMRG") to file a comment on its behalf regarding the Proposed Cleanup Alternative for the Bozeman Solvent Site (hereinafter "BSS"). As you know, the comment period for the Feasibility Study and Proposed Plan expires today at 11:59 p.m. MST.

RMRG purchased the Bozeman Shopping Center (hereinafter "BSC"), also known as the Hastings Shopping Center, from a subsidiary of Albertson's Inc./Jewel Food Stores, Inc. indemnified RMRG for liability arising out of or related to the BSS. Although this protection affords RMRG liability security to an extent, it does not protect RMRG from (a) impairment to the marketability of the BSC; (b)diminution to the fair market value of the BSC; or (c) loss of rents, profits or business advantage, which includes the loss of development opportunities. It also does not protect RMRG from certain expenses incurred as a result of the adoption of any governmental laws, rules, regulations, actions or guidelines. This means that RMRG will bear any additional costs associated with new permitting requirements and/or other requirements associated with construction or development to the BSC.

Response: In Section 3.8 of the Site Access and Indemnity Agreement between Jewel Food Stores, Inc. and RMRG Portfolio, LLC dated December 13, 2002 (Agreement, 2002), RMRG Portfolio, LLC negotiated an indemnification clause with the seller that excluded expenses related to impairment of the marketability of the property, diminution in the fair market value of the property, and any loss of rents, profits or business advantage, which includes the loss of development opportunities related to the releases from the BSS, the ROD, and the application of any governmental laws, rules, regulations, actions or guidelines. According to this Agreement, RMRG Portfolio, LLC purchased this property with full knowledge and disclosure of the environmental issues related to the property and was indemnified by the seller except with regard to the contracted exceptions. While DEQ appreciates RMRG Portfolio, LLC's concern that it may bear additional costs associated with new permitting requirements and/or other requirements associated with restrictions on development of the BSC, it is clear that RMRB Portfolio, LLC was aware that the BSC was a CECRA facility and would be subject to future remedial actions at the time of its purchase of the BSC.

RMRG understands that the purpose of remedial action performed under the Comprehensive Environmental Cleanup and Responsibility Act (hereinafter "CECRA") is to "attain a degree of cleanup of the hazardous or deleterious substance and control of a threatened release or further release of that substance that assures protection of public health, safety, and welfare and of the environment." M.C.A. § 75-10-721(1)(2010). Of course, RMRG fully supports protecting public health, safety, and welfare, and the environment. However, it is RMRG's position that before the Montana Department of Environmental Quality (hereinafter "DEQ") approves the Preferred Remedy set forth in Section 11 of the Proposed Plan, that it determine the actual impact the Preferred Remedy will have on properties subject to and affected by the implementation of the remedial action. Specifically, RMRG requests that the DEQ consider the economical impact the Preferred Remedy will have on the BSC.

Response: CECRA identifies what criteria DEQ is required to evaluate when selecting the final remedy (Section 75-10-721, MCA). Specifically, these criteria include protection of public, health, safety, and welfare and the environment; compliance with applicable or relevant environmental requirements, criteria, or limitations; mitigation of risk; effectiveness and reliability in the short-term and long-term; technically practicable and implementable; treatment technologies or resource recovery technologies; and cost effectiveness. These criteria were evaluated in the FS (NE&W, 2011d), the Proposed Plan (DEQ, 2011b), and the ROD. In addition, CECRA also requires that DEQ consider the acceptability of the remedial action to the affected community, as indicated by community members and the local government (Section 75-10-721(3), MCA). DEQ met this requirement by requesting public comment on the Proposed Plan. DEQ declines to conduct an economic impact statement in addition to the cost-effectiveness evaluation provided in the FS and Proposed Plan. An economic impact statement is not required by CECRA. Finally, the remedy may have a positive economic

impact on the BSC; once the remedy is complete, the site can be removed from the CECRA priority list. The value of uncontaminated property no long considered a maximum priority state superfund facility will likely exceed the value of the property as it now exists.

Of particular concern to RMRG are the proposed institutional controls. While RMRG concedes that the DEQ is required to implement cost effective institutional controls pursuant to M.C.A. § 75-10-721 (2)(c)(v), RMRG does not believe the Legislature intended that innocent land and business owners like RMRG should/would bear substantial costs in order to comply with the institutional controls chosen by the DEQ. That is, entities and persons in RMRG's position should not bear the costs in order for the City and State to save money.

Response: During preparation of the ROD and this responsiveness summary, DEQ became aware that RMRG Portfolio, LLC is no longer associated with the BSC properties (Phillips, 2011). Bozeman Shopping Center LLC and Bozeman Shopping Center III, LLC are the current owners of Lots 1 and 2, respectively of the BSC (Deed, 2004 and 2005a; and Phillips, 2011). Red Mountain Retail Group, Inc. and Red Mountain Group, Inc. are both managers of Bozeman Shopping Center LLC and Bozeman Shopping Center III, LLC (Phillips, 2011). As Bozeman Shopping Center, LLC and Bozeman Shopping Center III, LLC are the current owners or operators of the contaminated property, they are potentially liable for remediation under Section 75-10-715, MCA. DEQ does not view RMRG Portfolio, LLC, Red Mountain Retail Group, Inc., Red Mountain Group, Inc., Bozeman Shopping Center, LLC, or Bozeman Shopping Center III, LLC (collectively referred to as RMRG by DEQ, unless otherwise noted) as innocent land owners; that defense is provided for in CECRA and it is unlikely RMRG would qualify given that RMRG purchased the property with full knowledge of the contamination. In addition, in the Purchase Agreement, RMRG agreed to the "Least Stringent Remediation Standard Acceptable" for the "use of the Property as currently used." The current use of the property is commercial, so limitations on future residential use were contemplated at the time RMRG purchased the property. In addition, a Declaration of Covenants, Conditions, Restrictions and Reciprocal Easements was placed on the property on June 30, 2004 which indicate that "permitted uses" of the BSC are "retail sales and services, or other related commercial uses" and "prohibited uses" of the BSC include, but are not limited to, mobile home parks, trailer courts, hotels, motor inns, living quarters, sleeping apartments, or lodging rooms (Declaration, 2004). These prohibitions indicate that the RMRG has already restricted residential use at the property. Finally, CECRA's remedy selection criteria in Section 75-10-721, MCA, requires DEQ to consider institutional controls and Section 75-10-727, MCA, allows the placement of institutional controls on a property to mitigate the risk posed to the public health, safety, and welfare and the environment. As provided in Section 75-10-727, MCA, DEQ will require these residential use restrictions to continue on Lot 1 of the BSC and that portion of Lot 2 that exceeds site-specific cleanup levels (SSCLs). DEQ is requiring this restriction because SSCLs are based on the property being used as commercial/industrial. The BSC is currently zoned as B-2 (Community Business) by the City of Bozeman (Bozeman, 2010). If COC concentrations are reduced to levels that allow unrestricted use of the property in the future, Section 75-10-721(4), MCA, provides for lifting of the institutional control.

In addition, DEQ will require that no construction or development of structures occurs on the northwest corner of Lot 2. DEQ is requiring this restriction because this is the residual source area where active treatment will occur, and construction or development in this area may interfere with the active treatment. Currently, no structures exist on Lot 2. In response to this comment, however, DEQ has clarified and narrowed, to the maximum extent possible, the properties at the BSC subject to these controls. Specifically, as part of remedial design, DEQ will require that the active treatment area be

surveyed and only that limited surveyed area will be included in the restrictive covenant.

Finally, DEQ notes that it received a letter from Eric Nelson, Vice President of Red Mountain Retail Group, Inc. on March 31, 2011. Because the letter was received after the public comment period had closed, DEQ is not including it in this Responsiveness Summary. However, DEQ notes that in this letter, Red Mountain Retail Group, Inc. states that it "supports the remedial alternatives set forth in the Proposed Plan," and indicates that its attorney was merely seeking clarification of certain issues.

RMRG's position is supported by CECRA in that the DEQ is required to "consider the acceptability of the actions to the affected community, as indicated by community members and the local government," and that the DEQ must "give due consideration to institutional controls." See M.C.A. § 75-10-721(2)-(3) (emphasis added). "Due consideration" is defined as "[t]he degree of attention properly paid to something, as the circumstances merit." <u>*Black's Law Dictionary*</u> *574 (9^{th} ed. 2009). However, the Proposed Plan does not include evidence of such consideration. Rather, out of approximately 45 pages, it devotes less than a single page to explain how the DEQ assessed and determined the institutional controls that it did. See M.C.A. § 75-10-721(2)(c). This is problematic for a number of reasons:*

1. *M.C.A. § 75-10-721(2)(c) requires that the DEQ consider present uses when selecting institutional controls. In addition, the first of the four factors set forth in 75-10-701(18) entails assessing "local land and resource use regulations, ordinances, restriction, or covenants." Yet, there is insufficient information in the Proposed Plan that provides an in-depth explanation of what the present uses are and the extent to which they were considered. Instead, the DEQ only states that the "future use of the properties that make up the BSS will be residential, commercial, light industrial, and agriculture." Considering the current local uses is necessary to evaluate the impact that removing certain uses would/could have on properties within the BSS that currently enjoy the option to use the land in a number of different ways.*

<u>**Response**</u>: Section 75-10-721(2)(c) requires DEQ to consider "present and reasonably anticipated future uses" of the facility when evaluating remedial alternatives. DEQ evaluates present use of property through information provided by landowners, site inspections, and information provided by liable parties in the remedial investigation or other documents. For example, the RI Report (NE&W, 1999b), the BHHRA (DEQ, 2010c), and the final draft FS (NE&W, 2011d) provided descriptions of current and future land use of the BSS. Current use can be determined during a site visit. DEQ conducted a site visit and observed how the BSC and the nearby properties are being used.

DEQ determined reasonably anticipated future use by assessing the four factors outlined in Section 75-10-701(18), MCA: 1) local land and resource use regulations, ordinances, restriction, or covenants; 2) historical and anticipated uses of the facility; 3) patterns of development in the immediate area; and 4) relevant indications of anticipated land use from the owner of the facility and local planning officials. To evaluate (1), (2), and (3), DEQ reviewed the current zoning for the BSC (Bozeman, 2010b), which is currently B-2 (Community Business). DEQ also reviewed the Bozeman City-County Planning Office's Master Plan for the North 19^{th} Avenue/Oak Street Corridor (Master Plan) (BCCPO, 1997). In addition, DEQ reviewed the information discussed in Section 2.1 of the Decision Summary to identify historical uses of the BSC. Based on this review, DEQ found that the current land use at the BSS includes commercial, light industrial, residential, and agricultural. The Master Plan indicates the agricultural uses will be transformed into commercial, light manufacturing,

and residential uses (BCCPO, 1997).

To identify the "relevant indications of anticipated land use from the owner of the facility," DEQ sent letters on November 10, 2010, and March 23, 2011, to RMRG Portfolio, LLC, requesting information on its anticipated future land use of the BSC property (DEQ, 2010g and 2011r). DEQ did not receive a response to either letter. Therefore, DEQ evaluated this factor primarily with reference to the Master Plan (BCCPO, 1997) as well as other available information, including the June 30, 2004, Declaration of Covenants, Conditions, Restrictions and Reciprocal Easements which contains specific permitted uses and prohibited uses, including a prohibition on "living quarters" at the BSC (Declaration, 2004).

Based on all information evaluated, DEQ determined that the reasonably anticipated future use of the BSS is commercial, light industrial, residential (except the BSC property), and agricultural [as allowed by applicable zoning], although it is likely that the agricultural uses will be transformed into commercial, light industrial, and residential uses. DEQ also determined that the reasonable anticipated future use of the BSC portion of the BSS is commercial/industrial.

2. *The DEQ "assumes" that the reasonably anticipated future use of the BSC is commercial/industrial, and "anticipates requiring restrictive covenants limiting the future use of the BSC property to commercial/industrial as part of the remedy." Making any assumptions when mandated to consider certain factors is dangerous and wrong. Even more, the DEQ has singled out the BSC property and intends to limit only that property within the entire BSS, without explaining why and even though the "reasonably anticipated future uses of the remainder of the BSS will generally remain the same." The DEQ failed to explain how it determined that future uses will "generally" remain the same. It also failed to fully explain exactly what the restrictive covenants would be and what they would entail, other than they would limit the future use to commercial/industrial uses. If the DEQ limits the BSC property to commercial/industrial uses, RMRG and its successors-in-interest will be restricted from uses that are currently allowed by the City of that will continue to be allowed in the remainder of the BSS.*

Response: See previous responses regarding the use of institutional controls and how they can be lifted. See also previous response regarding how DEQ determined "reasonably anticipated future use." Section 75-10-701(18), MCA, provides four different factors to consider in evaluating "reasonably anticipated future use," and the previous response indicates how DEQ evaluated those factors. For example, DEQ relied upon the land use controls already placed on the property by the landowner, such as the June 30, 2004 Declaration of Covenants, Conditions, Restrictions and Reciprocal Easements to assist with its evaluation (Declaration, 2004). In addition, given the size of the BSS, DEQ relied in large part on the Master Plan (BCCPO, 1997). DEQ did not "single out" the BSC property as stated in the comment. Contaminated soil is not present in off-site properties (NE&W, 1999b). The on-going PCE contamination to the groundwater plume indicates that soil contamination exceeding the SSCLs likely exists within the saturated zone and continues to dissolve into the groundwater (NE&W, 1999b and NE&W, 2011d). Off-site PCE concentrations in indoor air were less than the SSCLs (Kleinfelder, 2010a). In response to this and other comments, DEQ has clarified and narrowed, to the maximum extent possible, the properties at the BSC subject to these controls and the residential use restrictions on the BSC property only apply to Lot 1 and a portion of Lot 2 until concentrations are protective of residential use.

3. *The DEQ specifies that certain requirements to provide ventilation or other health and safety measures during construction trench activities will likely be a condition to receiving a building permit for any construction to "the BSC and properties immediately north of the BSC property," but fails to explain exactly what would be required in order to obtain a building permit, how the review process would change, and how much it would cost the builder to implement a ventilation system or "other health and safety measure." Presumably, an increase in building permit requirements would increase the costs of construction.*

Response: In the FS (NE&W, 2011d), the City proposed implementing a trench/excavation construction permit system to require a provision of fresh air mechanical ventilation for construction/utility excavations and trenches at the BSC and properties immediately north of the BSC to provide additional protection. The trench/construction length would be limited to 100 ft in length (ATC, 2011c). The construction trench and excavation permit system will require fresh air mechanical ventilation in construction trenches or excavations on Lots 1 and 2 of the BSC, the eastern edge of 1608 W. Beall St., 1602 W. Beall St., the southeast corner of 1605 W. Beall St., the southwest corner of 302 N. 16th Ave., and the City right of way associated with the intersection of W. Beall St. and N. 16th Ave (see Figure 18). Section 11.2.1.2 of the ROD provides further details of the trench and excavation dimensions. The permit system will be required to ensure protection of construction or utility workers until COC concentrations in soil vapors are below the SSCLs. The City has indicated that additional costs associated with processing of permit applications would be minimal (NE&W, 2011d). In addition, rental blowers are readily available in the Bozeman area with the minimum blower found on the market (500 cfm) will be more than adequate to provide the additional air flow of 150 cfm (Trihydro, 2011).

In addition, while institutional controls may be necessary, CECRA expressly requires that an institutional control "must be removed if there is not an unacceptable risk posed to public health, safety, and welfare and the environment." M.C.A. § 75-10-727(4) (emphasis added). There is no indication that the DEQ has considered this.

Response: See previous responses regarding the use of institutional controls and how they can be lifted. The statute speaks for itself and there is no separate need for DEQ action on it.

Finally, RMRG is concerned with Alternative 7, which pertains to Soil Vapor Extraction. This alternative would require "SVE points, or wells, to be installed inside the building, in addition to along the building perimeter." The Tables and Figures that pertain to potential SVE sites are not consistent with one another and therefore, do not show exactly how many of these systems will need to be installed and where they will be installed. Nor does the Proposed Plan explain exactly what entails installing and operating these systems. The installation and maintenance of a well within a retail/commercial business has a number of implications, which were not addressed in the Proposed Plan, and therefore, likely not even considered by the DEQ.

Response: The FS (NE&W, 2011d) and the Proposed Plan (DEQ, 2011b) are conceptual design documents for cost estimating purposes, and are not engineering design documents. A more detailed description for the SVE system for remediation of sub-slab soil vapors at the BSC building will be provided in a remedial design document following the ROD. Optimization testing of the system will be conducted to determine the number of and placement of the SVE points and the equipment necessary to acquire the proper radius of influence (ROI). If optimization testing during remedial design indicates that placement of SVE points inside of the BSC building is necessary to achieve the

appropriate ROI, the City and CVS will work with RMRG, Bozeman Shopping Center LLC, Bozeman Shopping Center III LLC, and the retail businesses to place those points in locations that will be the least disruptive to business. In addition, the installation of the points can be conducted before or after regular business hours or during hours when fewer customers are expected. The City and CVS have used this approach when conducting other investigations at the BSC, including, but not limited to, installing sub-slab soil vapor probes and monitoring wells, and it worked well to minimize disruptions to the businesses.

In essence, RMRG is concerned that the Proposed Plan lacks enough detail to determine the actual impact to its property, including the impact that it will have on existing or future tenants, and future construction and/or development. Because the potential impact to RMRG, its successor-in-interest, and to the current and future tenants at the BSC is substantial, RMRG insists that when approving the Proposed Plan and/or Preferred Remedy, the DEQ consider the actual impact it will have on the BSC and other subject properties.

Response: The Proposed Plan is a document used to facilitate public involvement in the remedy selection process (EPA, 1999b). It presents DEQ's preliminary recommendation on how to best address the contamination at the facility, presents alternatives that were considered, and explains the reason DEQ recommends the preferred alternative. It is meant to provide brief summaries (EPA, 199b) as opposed to being a detailed document like the ROD. In the ROD, DEQ fully evaluated the remedial alternatives as required by Section 75-10-721, MCA, and has selected the remedy for cleaning up the BSS which best balances these criteria. In addition, Red Mountain Retail Group Inc.'s March 31, 2011 letter, indicated it supports the remedial alternatives set forth in the Proposed Plan and appreciates DEQ's efforts to "identify and implement the appropriate alternatives to remediate" the BSS. The remedial design planning will take into consideration the potential impacts to tenants and the public and minimize such impacts to the extent possible.

3.5 Comments from the City of Bozeman and CVS Pharmacy

The City of Bozeman (City) and CVS Pharmacy (CVS) are pleased with the recent progress that has been made at the Bozeman Solvent Site, including the issuance by the MDEQ of the Draft Feasibility Study (FS) and the Proposed Plan (PP) for public comment. Pursuant to the PP, the MDEQ has determined that the preferred combination of alternative remedies to remediate the BSS include: enhanced bioremediation for treatment of the on-site residual source of contamination; SVE (soil vapor extraction) for the soil vapor including the on-site sub-slab; new or deeper replacement drinking water wells for parcels north of the East Gallatin River that are impacted with COCs (chemical of concerns); and MNA (monitored natural attenuation) for the off-site dissolved plume. The MDEQ has also determined that the common elements of connection of impacted properties south the of the East Gallatin River to City water services and long-term monitoring will continue and that a trench permitting system directly north of the BSC would be implemented. The City and CVS are ready and willing to implement the preferred combination of alternatives identified by the MDEQ in the PP. The City and CVS are hopeful that, given the priority for the BSS, the Record of Decision may be issued sooner than the identified deadline of July 2011. In that event, the City and CVS would begin on the ground remediation in the late summer or early fall of 2011. Remediation is the greatest step that can be taken toward protecting public health. Like MDEQ, the City and CVS are committed to achieving final clean up as expeditiously as possible.

Response: DEQ appreciates the willingness of the City and CVS to implement the ROD. Remedial design of the remedy can begin as soon as the ROD is issued and an Administrative Order on Consent

(or other legal document) between DEQ, the City, and CVS is in place. DEQ expects that portions of the final remedy will be implemented in 2011.